

THE ORGANIZATION OF JAPANESE PROSODY

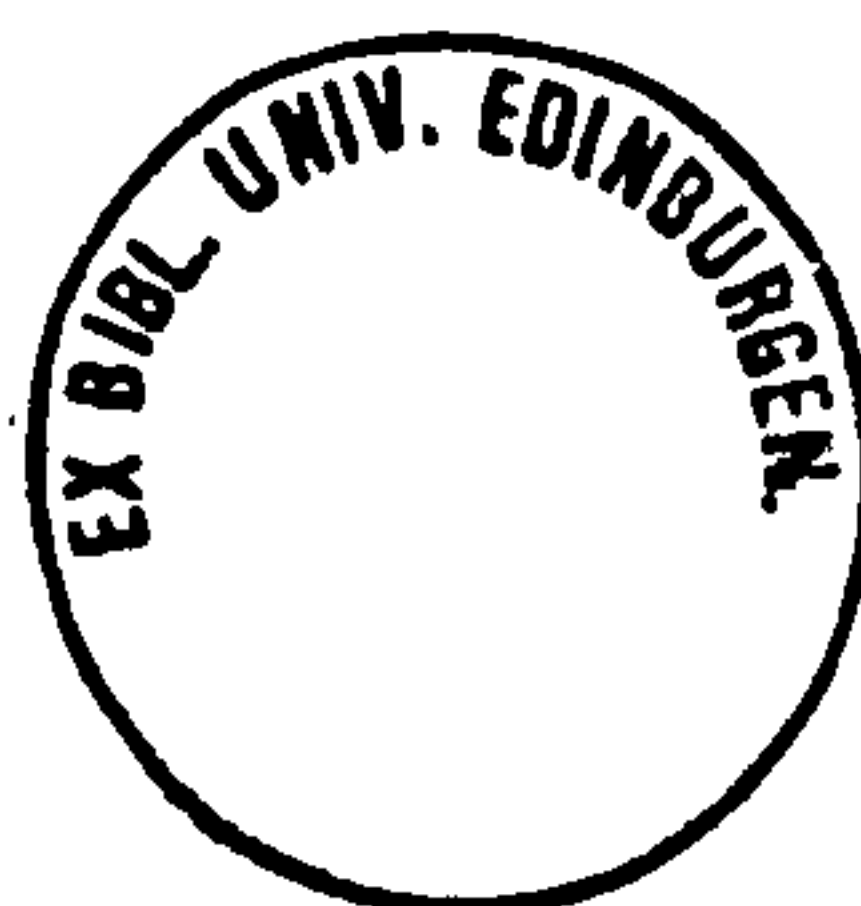
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CHAPTER FOUR

INTONATIONAL PHRASES AND PHRASING

In the preceding three chapters I have discussed various problems regarding the phonetics and phonology of Japanese word accent and tone. In this and the next chapter, I will explore the organization of Japanese prosody in a wider context by examining the intonational structure of the language.

Previous research on Japanese intonation has centered around the issue of what is generally known as 'declination' or 'downdrift', the phenomenon whereby pitch gradually declines during the course of utterances. Before discussing this issue in Chapter Five, I will discuss in this chapter various problems regarding intonational phrases and phrasing and, in so doing, consider the organization of Japanese prosody in further depth. Of special interest are such questions as the relation between syntax and prosody, the principle of rhythmic alternation and the role of word accent in intonational phenomena.

To do this, I will first give a brief review of the previous work on intonational phrases and phrasing, with emphasis on questions that have been controversial in the literature (Section 1). From section 2 through section 5, I will demonstrate several fallacies previously accepted as true concerning 'major phrase' and 'minor phrase,' the two intonational phrases by which the



intonational structure of Japanese is believed to be organized.^{<1>}

In section 2, I will show the inadequacy of some of the criteria whereby 'major phrase' has been defined, notably the inadequacy of defining the phrase on the surface configuration of F0 contours. In section 3, I will refute the notion of 'minimal minor phrase,' to claim that the intonational structure of Japanese is not constrained by the morphological structure as severely as has been thought. In section 4, I will argue against Poser's claim that total downstep (his 'total catathesis') does not occur in Japanese, and consider the implications and consequences of this new evidence for the modelling of Japanese intonation. This is followed by a discussion of initial lowering in section 5, where various factors influencing the surface realization of initial lowering are summarized.

The last section of this chapter (section 6) deals with the prosodic process of 'minor phrase formation (MPF)' which, as already noted in Chapter Two, has the effect of combining two (or more) words or phrases into a single minor phrase. Various linguistic conditions on the prosodic process will be discussed, and the controversies that have been unsolved will be settled in the light of experimental evidence.

1. REVIEW OF PAST WORK

1.1. Basic Assumptions

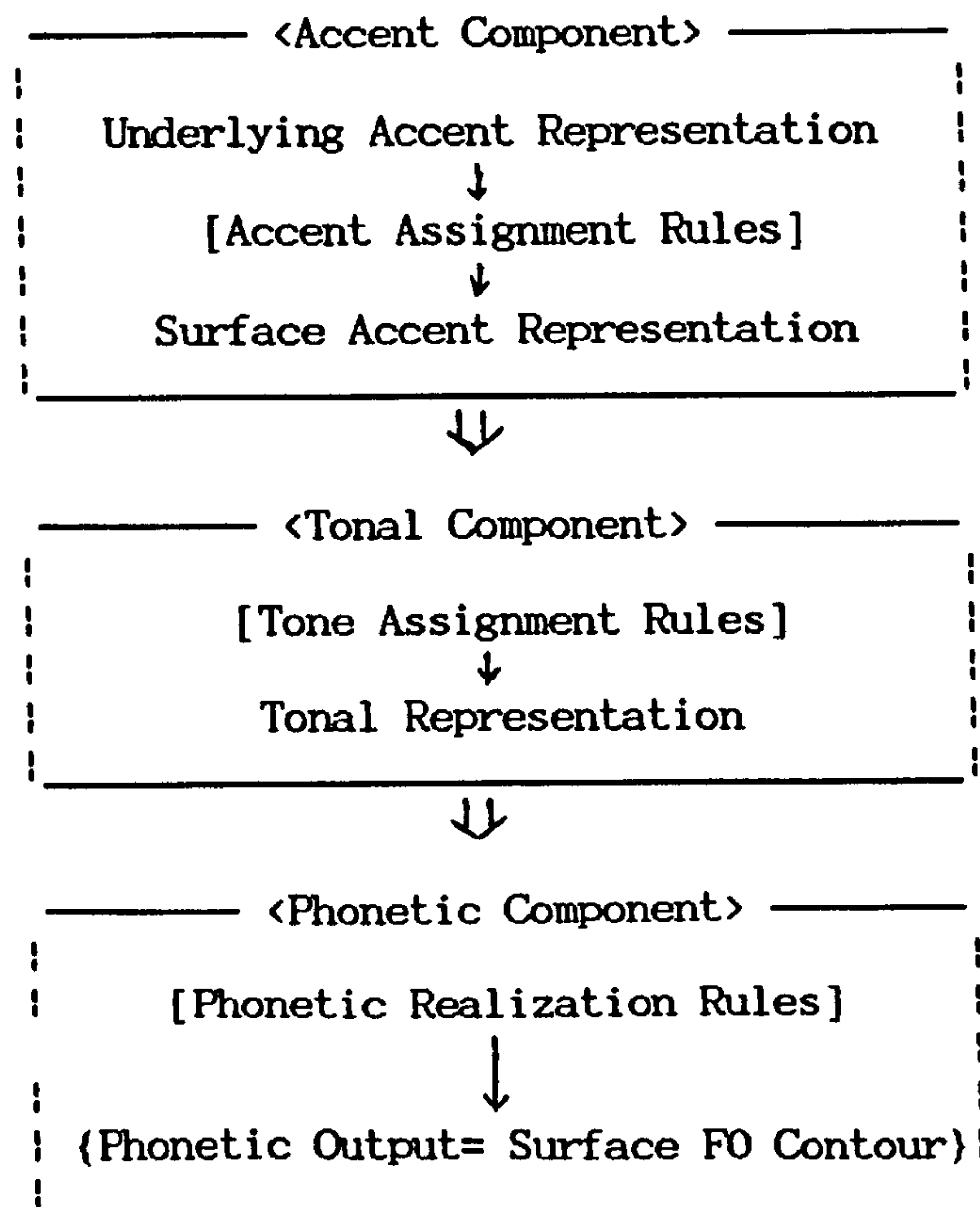
The subject of Japanese intonation has aroused quite a few controversies some of which still remain unsettled. As a result of these controversies, there have emerged different conceptions as to the organization of the intonational system of Japanese as well as the interpretation of some particular intonational phenomena.

Despite the differences, previous work on Japanese intonation has several assumptions and features in common. One of the most basic of these will be the conception of intonational structure as a structure of intonational phrases or categories. That is, virtually all the intonational models that have been put forward in the past adopt the approach whereby the intonational system of the language can be described as a system of intonational phrases. Specifically, previous studies assume two distinct intonational phrases (or categories) which, following McCawley (1968) and Poser (1984), I call 'major phrase' and 'minor phrase'. By integrating these two types of intonational phrases into one organic system in some way or other, it is believed that all the intonational phenomena can be defined in the system accurately and exhaustively.

A second assumption apparently underlying the previous models of Japanese intonation concerns the position of the intonation component in the whole phonological system of the language. It was mentioned in Chapter One (section 1.1.2) that

the prosodic system of Japanese accent and tone involves three phases — accentual, tonal and phonetic — as illustrated in (1) below.

(1) Organization of Japanese Tone and Intonation



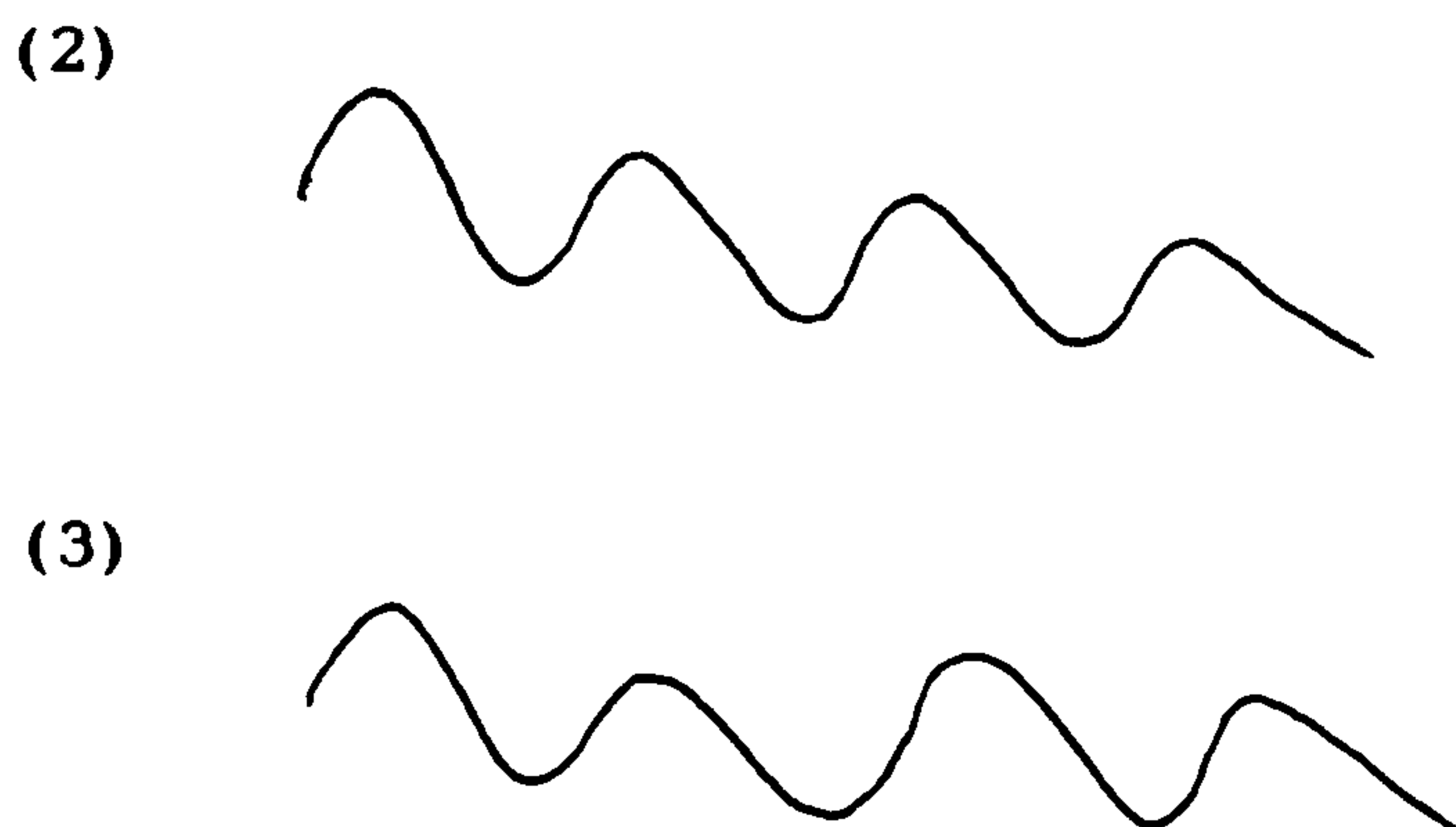
Intonational processes are defined at two different levels in this rule system, some at the level where accentual representations are translated into tonal representations and the others at the level where the tonal representations are phonetically interpreted into actual F0 contours. The former type of intonational processes consist of intonational phrasing processes whereby intonational structures are constructed for each utterance in terms of the two types of intonational phrases.

Minor phrase formation (MPF), which will be discussed in section 6 below, is a typical example of this type of intonational processes. Tone assignment rules apply to the output of this phrase, and yield tonal representations with minor phrase as the domain of their application. The tonal representations thus assigned to each minor phrase (and, hence, for each utterance) are to be translated into F0 contours by phonetic realization rules (PRRs), and it is at this stage that the other type of intonational processes are defined. The intonational processes that apply at this stage include those of 'declination' (which I will characterize as 'downstep' in this thesis : cf. Chapter Five), 'accentual boost' and 'accentual fall' (which I discussed in Chapter Three, sections 2 and 1 respectively).

1.2. Major Phrase

Having seen the two basic assumptions underlying the previous intonational models of Japanese, let us first consider the nature of the two types of intonational phrases, "major (intonational) phrase" and "minor (intonational) phrase." Different researchers use different terms for these two types of intonational phrases and, to make the matter worse, very few of them define the concepts in a sufficiently clear-cut manner. There is, however, one thing which has been commonly done by the previous researchers. That is, previous analyses attempt to identify the two types of intonational phrases primarily on the basis of the surface configuration of F0 contours.^{<2>} To illustrate this, let us suppose two hypothetical F0 contours as

shown in (2) and (3) respectively.

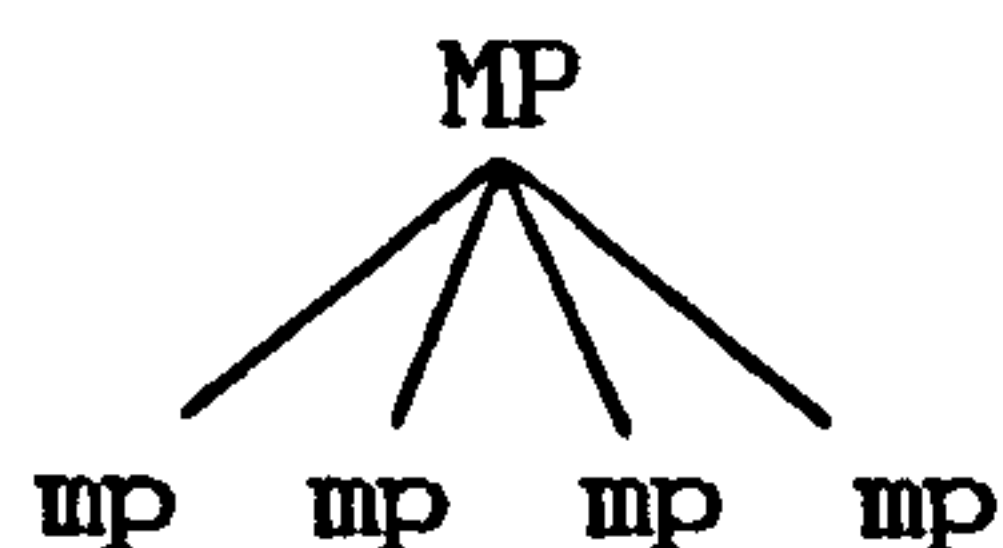


Both of these contours are characterized by a rise (initial lowering) at four different points each of which is followed by a rather sharp drop (accentual fall). Referring to each chunk of speech characterized by this initial pitch rise and a following pitch fall as a "minor phrase," the F0 contours in (2) and (3) can be defined as comprising four minor phrases.

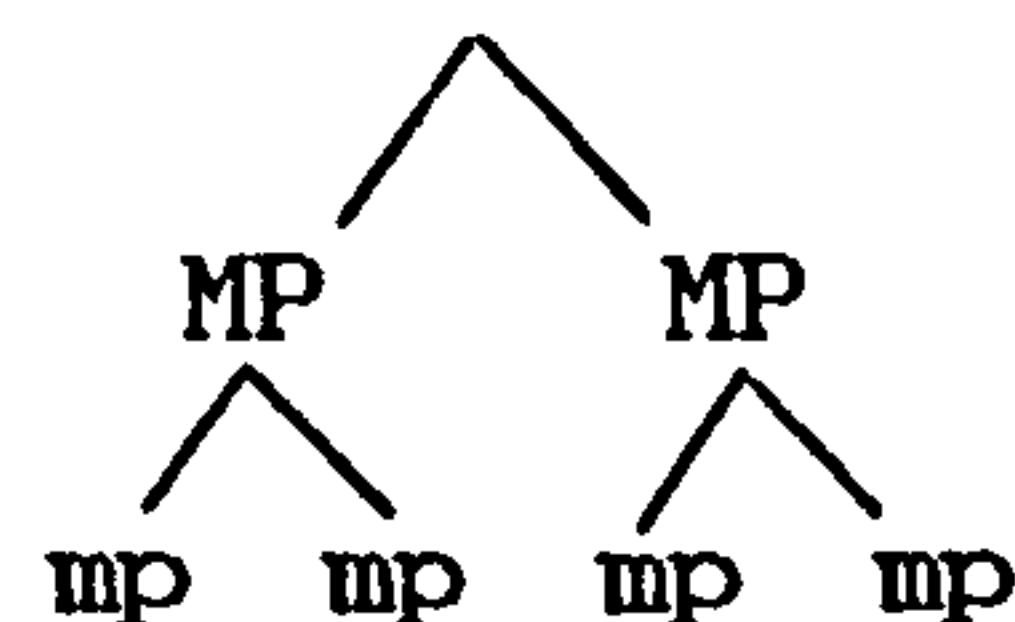
Although the two contours are made up of the same number of minor phrases, they cannot be said to represent the same F0 pattern. The crucial difference between the two contours lies in the relative height of the third minor phrase. In (2), each minor phrase is realized at a lower level than the minor phrase which immediately precedes it, yielding a descending staircase as a whole. In (3), by contrast, the third minor phrase is realized at a higher level than the second minor phrase although the second and fourth minor phrases are lower than the minor phrases which immediately precede them respectively. The traditional analyses generally attribute this difference to a difference in

intonational phrasing. That is, the four minor phrases in (2) are seen to belong to a single larger intonational phrase whereas those in (3) are viewed as constituting two larger phrases with a major intonational boundary between the second and third minor phrases. If we call this larger size of intonational phrase "major phrase," the difference between the two F0 contours can be shown as in (4) and (5).^{<3>} ('MP' and 'mp' denote 'major phrase' and 'minor phrase' respectively.)

(4) (= (2))



(5) (= (3))^{<4>}



The type of intonational unit I call "major phrase" has been given different names by different people, as summarized in Table 1. However, none of these people proposes a clear-cut definition of the term, or shows how their definition differs from that of others.^{<5>}

Table 1 Different Terms for 'Major Phrase'

McCawley (1968)	major phrase
Shibatani (1972)	major phrase
Fujisaki & Sudo (1971)	voicing unit
Miyara (1981)	intonational phrase
Poser (1984)	major phrase
Beckman & Pierrehumbert (1986)	major phrase (?)

Although the surface configuration of F0 contours has been taken as a point of departure by the previous researchers, it is not the only criterion whereby the intonational phrase is defined. One finds two other criteria in the literature. One of them is what I call a 'syntactic criterion' (or 'morphosyntactic criterion') by which to define 'major phrase' in reference to some syntactic features of utterances. ^{<6>}

Fujisaki states, for instance, that 'major phrase' (his 'voicing unit') corresponds to the "interval between pauses, whether respiratory or non-respiratory, that interrupt phonation" and that the phonation is interrupted "for the purpose of marking major syntactic boundaries within a sentence" (Fujisaki & Sudo, 1971:76). ^{<7>} This line of definition is obviously based on the observation that F0 contours tend to be 'renewed,' as it were, at major syntactic boundaries of utterances. In other words, Fujisaki's analysis is based on his general observation that

major syntactic boundaries are often signalled by the interruption of a descending staircase as seen in the middle of the contour in (3). Although my observation supports Fujisaki's observation for the most part, his observation describes no more than a general 'tendency' and we cannot obviously establish a one-to-one correspondence between a 'major syntactic boundary' and a 'major phrase boundary.' I will discuss this point in section 2.

Poser (1984) defines morpho-syntactic criteria a little more clearly. He states, for example, that the "topic phrase (marked by the particle wa) is generally set off from the rest of the sentence by a major phrase boundary" (p. 146). Just like Fujisaki's statement, this statement appears to be based on his own impressionistic observation that F0 contours are 'renewed' by a remarkable pitch rise that takes place at the position immediately following the topic phrase. In other words, his observation is not based on any experimental evidence to the effect that the topic phrase exerts no effect on the material following it. <8>

Besides the syntactic criteria that have been briefly sketched, one can find one more approach to the definition of the major phrase, which I call the "phonological definition." This approach attempts to define the intonational phrase as the domain of some phonological process. The assumption most commonly held in the literature is that the major phrase is the domain of the downward trend of pitch generally known as 'declination' or 'downstep'. For example, McCawley (1968:176), who characterizes

this process as an accent reduction process, states that the major phrase is a "sequence of minor phrases of which the first has a primary accent and the rest secondary accent."^{<9>} Poser (1984) also defines the major phrase as the domain of the downward pitch phenomenon although he interprets this phenomenon not as an accent reduction process but as a lowering of pitch range triggered by accent ('downstep').^{<10>} A similar definition is made by Fujisaki too, for whom the major phrase (his 'voicing unit') is the domain of 'declination.'

1.3. Minor Phrase

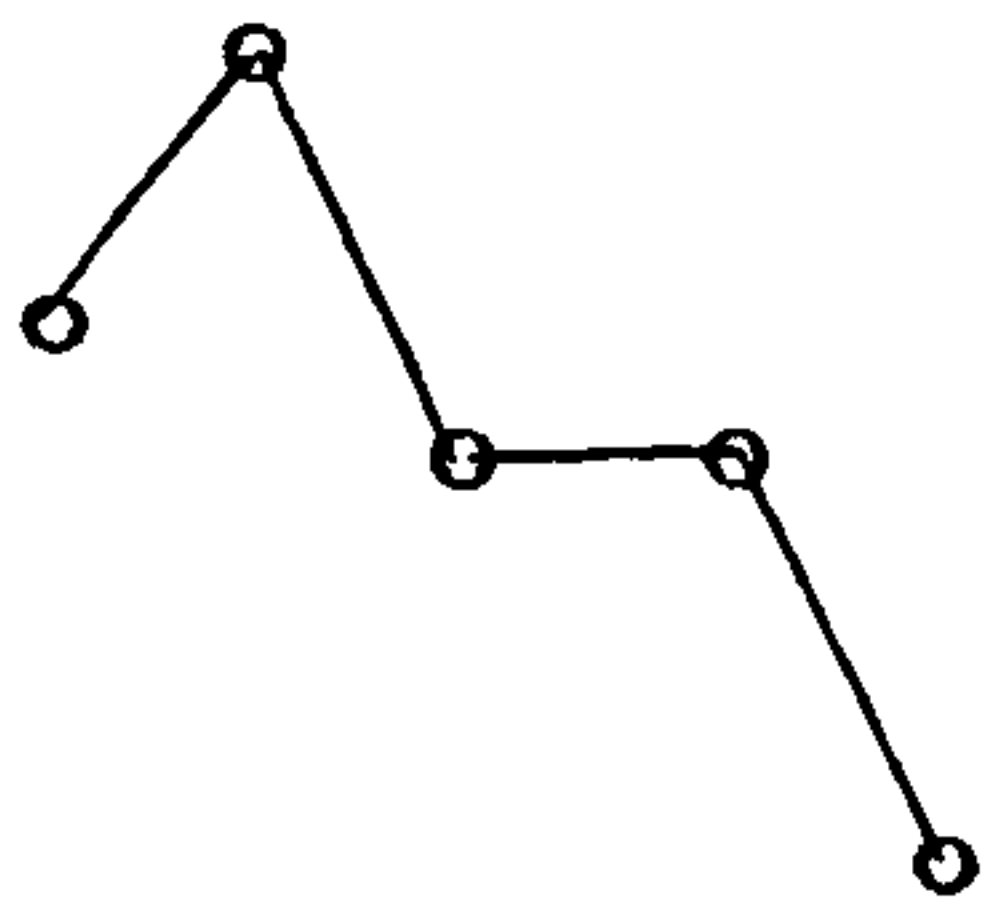
Just like the major phrase, the smaller size of intonational phrase, which I call 'minor phrase' in this thesis, is named in various ways.^{<11>} Table 2 summarizes this.

Table 2

McCawley (1968)	minor phrase
Shibatani (1972)	minor phrase
Fujisaki & Sudo (1971)	accent phrase (accent unit)
Kohno (1980)	minor phonological phrase
Poser (1984)	minor phrase
Beckman & Pierrehumbert (1986)	accentual phrase

In comparison with the major phrase, the minor phrase is

(7) Total Downstep



In addition to the phonetic/phonological definition of the minor phrase, there is another line of approach in the literature, which I term 'morphosyntactic' definition. McCawley (1968) and Poser (1984), for instance, assume that certain sequences of morphemes^{<15>} form a sort of basic intonational unit which is always realized in the same minor phrase. To be more specific, McCawley and Poser assume that any sequence of a lexical item (noun, verb, adjective, determiner or adverb) plus any particles which follow it^{<16>} is never realized in two minor phrases but has only two choices in intonational phrasing (IP): (a) either they form a single minor phrase on their own, or (b) they form a unified minor phrase in combination with other similar sequences. (8) illustrates this with the sequence of a noun and a particle, the simplest form of phrase in Japanese.

(8) "Minimal Minor Phrase"

ka'nada-ma'de itta

"Canada" "to" "went"
= "(I) went to Canada"

a) Input to IP ka'nada ma'de itta

Output of IP % ka'nada ma'de % itta %

Phonetic ka[nadamade i]tta
Output

b) Input to IP ka'nada ma'de itta
 Output of IP % ka'nada ma'de itta %

Phonetic ka]nadamade itta
 Output

This morphosyntactic definition of the minor phrase is based on the following three assumptions. First, it assumes two types of morphemes in Japanese, those which can form a minor phrase on their own (e.g. nouns, verbs, etc.) and those which cannot (e.g. particles). It is assumed, in other words, that particles always form one minor phrase together with lexical items to which they are attached, and never constitute an independent minor phrase on their own. And second, the morphosyntactic definition of the minor phrase classifies sequences of morphemes into two kinds, those constituting a single minimal minor phrase and those involving more than one such phrase. To be specific, the morphosyntactic definition treats amerika-kara "from America," a typical sequence constituting a minimal minor phrase, in a different way from akai hana "red flower," which consists of two minimal minor phrases. And third, the morphosyntactic definition of the minor phrase assumes an intonational rule or process whereby two (or more) minimal minor phrases are realized in one unified minor phrase. This process, which will be outlined shortly, supposedly accounts for the variation in intonational phrasing such as those shown in (8a)-(8b) above.

1.4. Minor Phrase Formation

1.4.1. Terms and Basic Assumptions

Having sketched the two types of intonational phrases generally assumed to constitute the intonational system of Japanese, I will now address the process of minor phrase formation (MPF), another controversial topic in this area. As pointed out just above, Japanese shows a variation in intonational patterning as illustrated in (9). In careful speech,^{<17>} Japanese speakers tend to choose the pronunciation in (9a) in which each component word or phrase is realized as an independent minor phrase. More often than not, however, they tend to combine two (or more) elements into a single minor phrase, as shown in (9b):

(9) Intonational Variation

akai hana "red flower"

a) % akai % hana % ==> aka*i* hana

b) % akai hana % ==> aka*i* hana

The traditional assumption on this kind of intonational variation is that the mono-phrasal pattern as in (9b) is derived from the bi-phrasal pattern as in (9a) by a certain phonological (intonational) rule. This rule has been termed in different ways by different people, reflecting the difference in the naming of 'minor phrase.'

Table 3

McCawley (1968)	minor phrase boundary (%) deletion rule
Fujisaki & Sudo (1971)	accent phrase formation (APF)
Kohno (1980)	minor phonological phrase incorporation
Poser (1984)	compression of minimal minor phrases

Instead of all these terms, I will employ the term "minor phrase formation (MPF)" in this thesis. The reasons for rejecting the previous terms are the following. First, Fujisaki's "accent phrase formation" has to be abandoned because there is a process in Japanese phonology to which this term is perfectly suited. As discussed in detail in Chapter 2 (section 2), the prosodic compound formation in Japanese has an effect of yielding one accentual unit out of the sequence of words which can potentially form individual accentual units, by way of modifying word accent patterns of the component words. Although this process is similar to the intonational process under consideration now (e.g. in terms of the various conditions on the rules), they produce different effects (the prosodic compound formation process defines the domain of the word accent assignment whereas the intonational process defines the domain of tone assignment) and must, therefore, be treated as independent processes in the phonological system of Japanese. If we use the term "accent phrase formation" in Japanese phonology at all, it should be used for the process which defines the domain of word

accent and not for the process whereby the domain of tonal melody is defined.

Next, there are two reasons to reject the terms by McCawley, Kohno and Poser. One reason I favor the term "MPF" in preference to the terms by McCawley and others is to keep the parallelism with the term "APF" which, as I said just above, shows behavior significantly similar to the intonational process we are discussing now.

A second and more important reason I reject the terms by McCawley and others is that I deny the notion that MPF is a process unifying two minor phrases into one. All the three previous names were coined on the assumption that there is a prosodic unit called "minimal minor phrase" (or anything equivalent to it) which is defined by syntactic/morphological criteria, and that the sequences of this type of units are combined at a certain stage of phonological derivation to form one minor phrase. I deny this assumption for the reasons to be given in section 6.1, in favor of the assumption that MPF is a syntax-phonology mapping process whereby one minor phrase is yielded out of the sequence of two syntactic/morphological units each of which can potentially form an independent minor phrase on its own.

Having justified the term "MPF", I will consider the basic assumptions underlying the previous analyses. In a word, the previous analyses commonly define the intonational process as an optional process of intonational phrasing by which "minimal minor

phrases are combined to form larger minor phrases" (Poser, p.152). This definition is based on several independent assumptions. First, it assumes that the intonational process is an optional process. This is obviously based on the observation that one and the same sequence of syntactic words exhibit more than one intonational pattern, as illustrated in (9) above.

A second assumption the traditional definition presupposes is that MPF is an intonational phrasing process. Since intonational phrasing processes are believed to apply between the accentual level and the level of tone assignment, it naturally follows that MPF is a process defined at this intermediate level.

And thirdly, the traditional definition of MPF assumes that it is a process whereby two minor phrases are unified into one minor phrase.^{<18>} As for the variation in (9), for example, it is generally assumed that the mono-phrasal intonational pattern in (9b) is derived from the 'underlying' pattern in (9a) under certain conditions. (10) and (11) illustrate this assumption ('IP' and 'TA' stand for intonational phrasing and tone assignment respectively).

(10) Traditional Account of MPF

% akai % hana % == (MPF) ==> % akai hana %

(11) Phonological Derivation Under (10)

	(9a)	(9b)
Input to IP	akai hana	akai hana
IP	% akai % hana %	% akai % hana %
MPF	————	% akai hana %
TA	% LHH % LH %	% LHHH %
Output	<u>a</u> √kai <u>ha</u> √na	<u>a</u> √kai hana

1.4.2. Conditions on MPF

Having outlined MPF, let me sketch the literature as to the conditions on this intonational process, or the factors influencing the choice of the intonational phrasing patterns. There are at least two types of conditions reported in the literature, accentual and syntactic, but opinions differ in the characterization of these individual conditions.

1.4.2.1. Accentual Condition

As for the accentual condition, previous accounts fall into two groups. Fujisaki & Sudo (1971) and Poser (1984) assume that MPF tends to be blocked between two elements if the first (left-hand) element is accented. That is, "other things being equal, an unaccented word is more likely to be attached to the word to its right than is an accented word" (Poser, p.155), with the accentedness of the second (right-hand) word playing no role. While this first group assumes that the accentedness of the second element is irrelevant, McCawley (1968), Hayata (1969) and Kohno (1980) assume that the accentedness of the second element

as well that of the first element is relevant. According to this second view, sequences of two words tend to form one minor phrase "if either of them is unaccented" (McCawley, p.177-178).

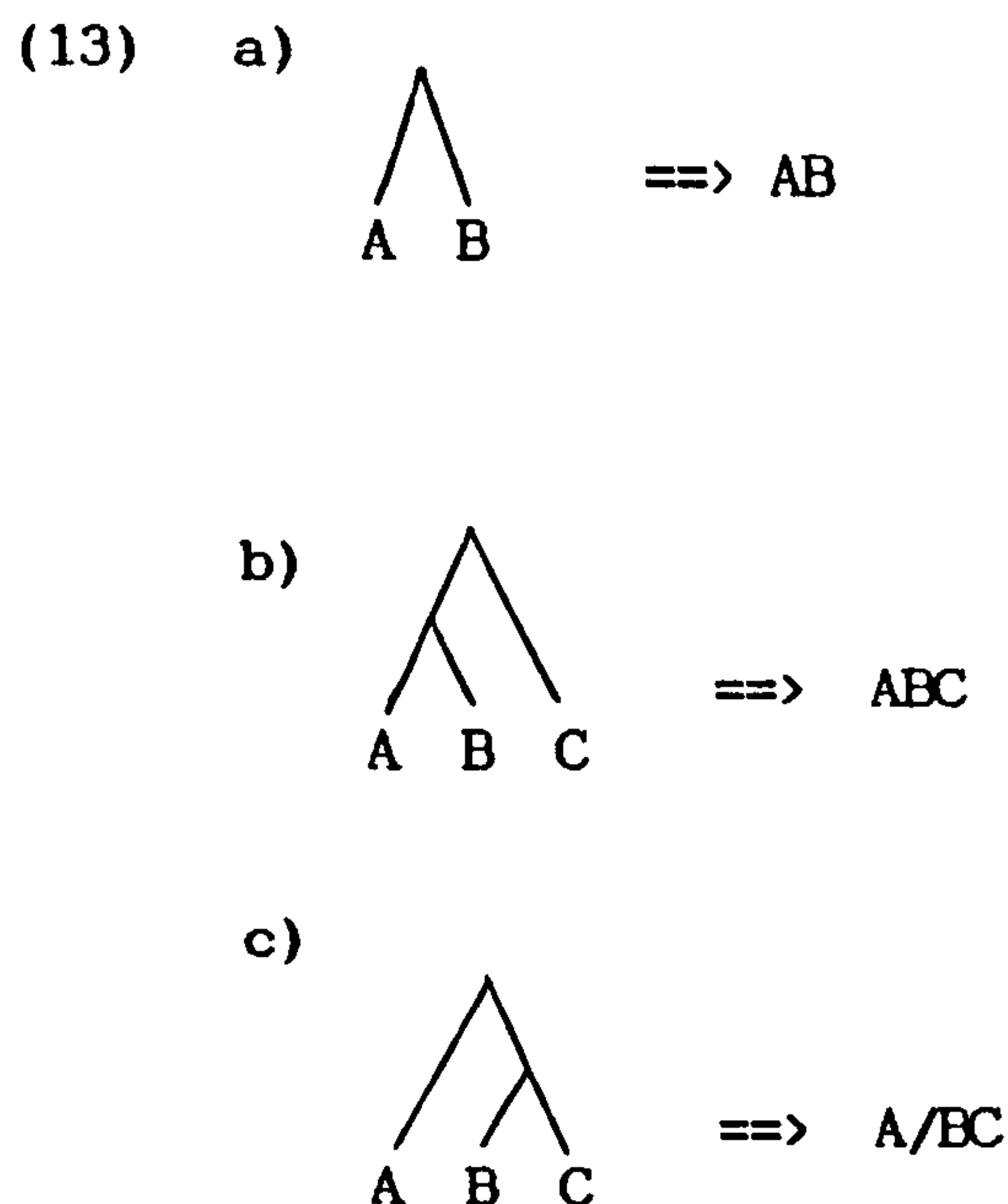
These two views of the accentual condition on MPF make different predictions. Given the four accentual combinations in (12) below, the Fujisaki-Poser hypothesis assumes that (12c) forms a natural class with (12d) as opposed to (12a) and (12b), which forms another natural class. By contrast, the hypothesis by McCawley and others draws a line between (12b)-(12d) and (12a), thereby treating (12a) as a string to which MPF generally fails to apply. I will discuss this controversy in section 6.2 below, where I provide experimental evidence to support the Fujisaki-Poser hypothesis.

- (12) a) [+A,+A] uma'i me'ron "tasty melon"
b) [+A,-A] uma'i oimo "tasty potato"
c) [-A,+A] amai me'ron "sweet melon"
d) [-A,-A] amai oimo "sweet potato"

1.4.2.2. Syntactic Condition

Just as opinions are divided into two in the characterization of the accentual condition on MPF, the literature provides two competing hypotheses on the effect of syntactic structure on the phrasing process. Fujisaki & Sudo (1971) propose (though implicitly) what I term "Branching Constraint hypothesis" (henceforth "BC hypothesis"), which states that MPF is blocked between two elements where the right-hand

member branches. In the sequence of unaccented words as given in (13), for instance, this BC hypothesis assumes that MPF is generally blocked between the first and second elements in (13c) while it is not blocked anywhere in (13a) and (13b) ('/' denotes a minor phrase boundary).



A quite different hypothesis concerning the syntactic effect on the intonational phrasing process is held by McCawley (1968) and Poser (1984). Their "proper syntactic analysis" hypothesis ("PSA hypothesis" for short) states that MPF applies cyclically along the syntactic constituent structure of phrases and sentences, and that "the possible intonational phrases are a subset of the proper syntactic analysis" (Poser, p.152). Under this hypothesis, the intonational phrasing patterns as illustrated in (14) are precluded, while those in (15) are permitted. <19>

(14) Impossible Phrasing Patterns Under PSA Hypothesis

a)

$$\begin{array}{c} \diagup \quad \diagdown \\ A \quad B \quad C \end{array} \implies *A/BC$$

b)

$$\begin{array}{c} \diagup \quad \diagdown \\ A \quad B \quad C \end{array} \implies *AB/C$$

(15) Possible Phrasing Patterns Under PSA Hypothesis

a)

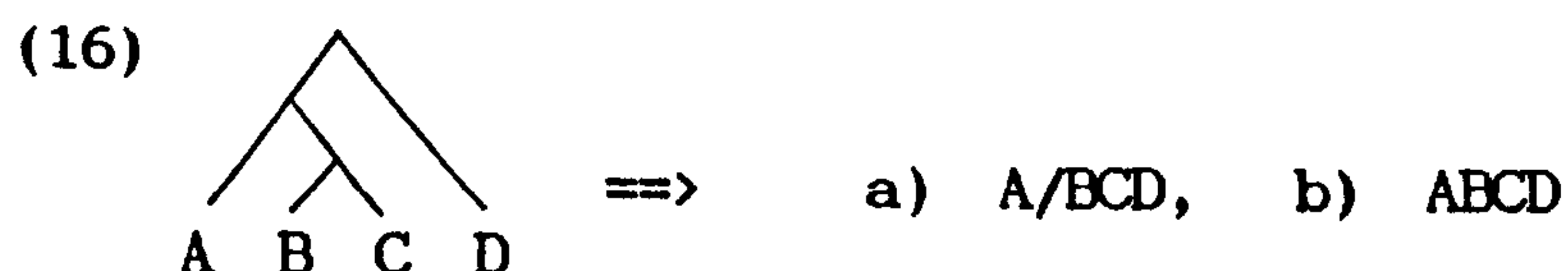
$$\begin{array}{c} \diagup \quad \diagdown \\ A \quad B \quad C \end{array} \implies AB/C, \quad ABC, \quad A/B/C$$

b)

$$\begin{array}{c} \diagup \quad \diagdown \\ A \quad B \quad C \end{array} \implies A/BC, \quad ABC, \quad A/B/C$$

The BC hypothesis and the PSA hypothesis differ crucially in two points. First, the BC hypothesis regards the right-branching structure as a prosodically marked structure while the PSA hypothesis makes no such discrimination in markedness. Second, and more important, the PSA hypothesis assumes that MPF is blocked at a given domain if it fails to apply at a lower domain, whereas under the BC hypothesis, the phrasing rule is supposed to be free from such domain condition. These differences lead the two hypotheses to make different predictions as to the possible patterns of phrases. Take the construction in (16), for

example, where the first three elements form a syntactic constituent to the exclusion of the last element. The PSA hypothesis precludes the possibility of the pattern in (16a) but permits the pattern in (16b). The BC hypothesis, on the other hand, makes a reverse prediction by rejecting the pattern in (16b), but not the pattern in (16a).



In section 6.3 below, I will show that the BC hypothesis makes the correct prediction and consider the theoretical implications of this hypothesis.

1.4.2.3. Other Conditions

In addition to the two types of conditions sketched so far, Poser further remarks that the choice of intonational phrasing is influenced by the "size and number of the minor phrases within a parent constituent" and that "there is a tendency to avoid constructing excessively large minor phrases" (Poser, p.155).^{<20>} He does not show any evidence to substantiate this claim, and no other person I know ever remarked on this kind of condition. I will show some experimental evidence to support Poser's remark in section 6.4 below, where I will claim that the tendency to avoid large minor phrases is attributable to the principle of rhythmic alternation.

2. On Major Intonational Phrases

Having sketched the traditional accounts of the intonational phrases and phrasing in Japanese, I will demonstrate in this and the next three sections several fallacies concerning the traditional definitions of the two types of intonational phrases. In this section, to begin with, I will point out the problems inherent in the traditional definitions of 'major phrase,' and argue that the several types of definition of the intonational phrase that have hitherto been given are not always compatible with each other. Specifically, I will present evidence to cast doubt on the validity of the phonetic definition whereby the intonational phrase is identified on the basis of the configuration of surface F0 contours.

In outlining the major phrase in section 1.2 above, I pointed out that there are three ways in the literature to define the major phrase. The most popular approach is to define the phrase in reference to the surface F0 contours. Given the F0 contours as in (17) and (18), for instance, this approach a priori assumes the intonational structures as in (19) and (20) respectively on the basis of the relative height of the component phrases.

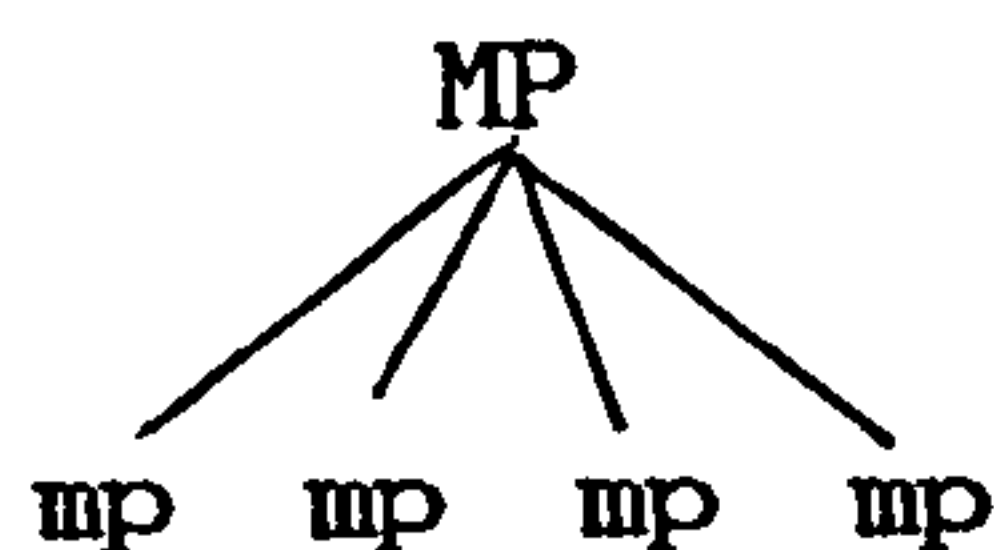
(17) (= (2))



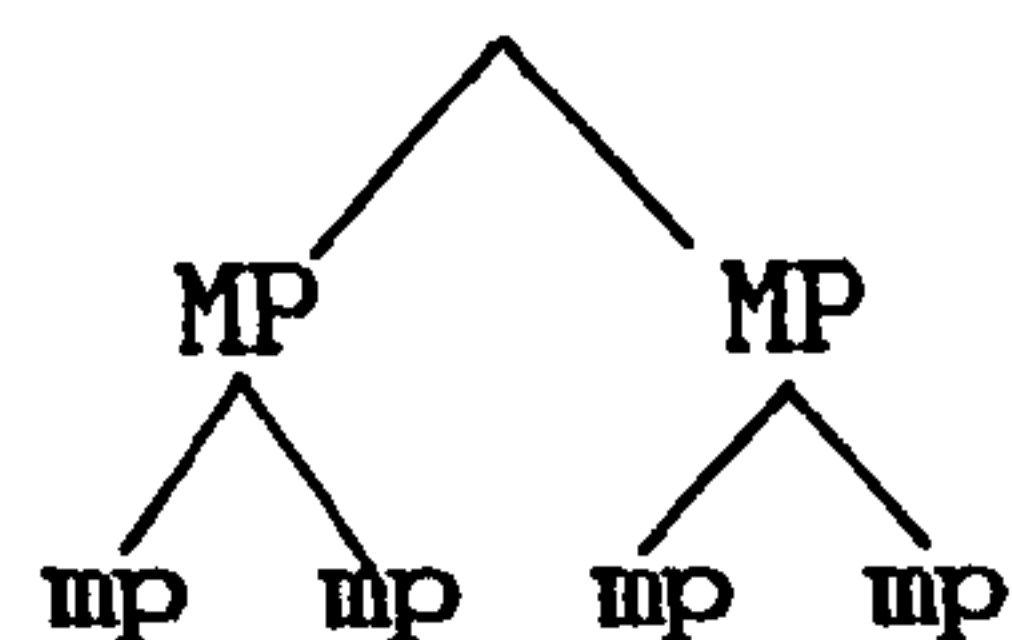
(18) (= (3))



(19)



(20)



A second approach to the definition of the major phrase, which I call the 'syntactic' approach or definition, relates the intonational structure with the syntactic structure of the utterance. On the assumption that intonational structures reflect syntactic structures in a rather straightforward manner, this approach views that major phrase boundaries roughly correspond to major syntactic boundaries, or in other words, that major syntactic boundaries are signalled by a big F0 rise, as seen in the third minor phrase in (18), which marks the beginning of a new major intonational phrase.

In addition to these two types of definition, there is a third approach which I termed the 'phonological' approach. This approach defines the major phrase as the domain of some phonological phenomena, specifically as that of the phenomenon whereby pitch gradually declines during the course of utterances. Given the F0 contour in (18), for instance, this approach a priori sees that the downward pitch process is blocked between the second and third minor phrases, and assigns, accordingly, the intonational structure in (20).

2.1. Phonetic vs. Syntactic Definitions

Dataset X includes the two phrases in (21) below, which both consist of four words (or simplex phrases). All the component words of these phrases are accented except the second word in (21b).

(21) a) na'okono a'nino ao'i eri'maki

"Naoko-Gen" "brother-Gen" "blue" "muffler"
= "Naoko's brother's blue muffler"

b) na'okono aneno ao'i eri'maki

"Naoko-Gen" "sister-Gen" "blue" "muffler"
= "Naoko's sister's blue muffler"

In syntactic terms, these phrases obviously do not involve a 'major syntactic boundary' at least in the ordinary sense of the term. The syntactic definition of the major phrase, therefore, predicts no major phrase boundary in the F0 contours these phrases exhibit. In the actual phonetic realization, however, these phrases yield an F0 pattern as illustrated in Figures 4.1 and 4.2, where the third minor phrase is realized at a higher pitch level than the second minor phrases in both cases. <21> This is, in fact, essentially the same pitch pattern as described in (18) above, a pattern which will be analyzed as having the intonational structure as in (20) by the phonetic definition. <22> This clearly shows that what looks like a major phrase boundary at the phonetic level cannot always be related with a major syntactic boundary.

In addition to this, there are cases where a major syntactic boundary is not realized as a major intonational phrase boundary.

The sentence in (22), for instance, may be said to involve some sort of 'major phrase boundary' between the two verbs totte and tabeta. According to my impressionistic observation, however, this sentence does not generally induce between the two verbs a major intonational boundary comparable to the one in (18).^{<23>}

(22) ta'rooga ta'koo to'tte ta'beta

"Taro-Nom" "octopus-Acc" "caught" "ate"
= "Taro caught an octopus and ate (it)"

All in all, major intonational phrase boundaries and major syntactic boundaries cannot always be linked with each other, and this suggests that we cannot readily define the notion of 'major phrase' on the basis of such syntactic notions as 'major syntactic boundary.'

2.2. Phonetic vs. Phonological Definitions

There are cases where the phonetic definition of the major phrase contradicts the phonological definition. As I mentioned above, it is generally agreed that the major phrase is the domain of the intonational phenomenon whereby pitch declines during the course of utterances. Given F0 contours as in (18), it has been assumed a priori that they consist of two major phrases, as illustrated in (20) above, because the third minor phrase is realized at a higher pitch level than the second minor phrase. For the same reason, it has been assumed a priori that the downward phenomenon is blocked between the second and third minor

phrases. Although these a priori assumptions may seem to be reasonable, they cannot necessarily be empirically justified.

Let me explain this with the downstep model proposed by Poser. As suggested in section 1.2, Poser defines the downward phenomenon as downstep, or an accent-induced downward shift of pitch range. This definition of the lowering phenomenon is based on his experimental evidence that words are realized at a significantly lower pitch level when they follow an accented word than when they follow an unaccented word. The two phrases in (23), for instance, show a significant difference in the height of the second word as well as in the height of the first word, as illustrated in Figure 4.4. That is, while the first word is realized at a significantly higher pitch level in (23a) than in (23b) due to the effect of accentual boost discussed in Chapter Three (section 2), the second word is given a lower pitch in (23a) than in (23b).

- (23) a) uma'i nomi'mono "tasty drink"
b) amai nomi'mono "sweet drink"

Although this characterization of the downward pitch phenomenon is justifiable, as will be shown in Chapter Five (section 2), his definition of the major phrase as the domain of this intonational process can contradict the phonetic definition. As mentioned above, both the two phrases in (21) exhibit F0 patterns in which the third minor phrase is given a higher pitch than the second minor phrase (cf. Figures 4.1-4.2). If the phonetic definition of the major phrase agrees with the phonological definition, it will be assumed that the downward F0 process has not taken place between the two phrases in (21a). In actual fact, however, an intonational phenomenon characterizable as downstep has taken place between these two phrases. This can be seen from Figure 4.3 where the third minor phrase, ao'i "blue", is realized at a substantially lower F0 level in the phrase in (21a) than in (21b). The difference in the height of this minor phrase is statistically significant, as will be shown in Chapter Five (section 4).

This experimental result clearly shows, contradicting the general belief, that what Poser characterizes as downstep ('catathesis') has taken place between the second and third minor phrases in (21a) although the third phrase happens to be given a higher pitch than the second phrase which has triggered the lowering phenomenon.^{<24>} In other words, the two lines of definitions of the major phrase — phonetic and phonological — do not agree with each other. If we adopt the phonetic definition of the major phrase, it follows that the F0 pattern shown by the phrase in (21a) (i.e. Figure 4.1) involves two

major phrases as illustrated in (20). If we adopt the phonological definition, on the other hand, it follows that Figure 4.1 involves just one major phrase as illustrated in (19).

Of these two competing interpretations, I would support the phonological interpretation in preference to the phonetic interpretation for the following reasons. If we reject the phonological definition in favor of the phonetic definition, we automatically have to abandon the definition of the major phrase as the domain of the downward intonational phenomenon (downstep) for which we will have to postulate a larger intonational phrase instead. This yields two unfavorable consequences. First, it requires us to posit a third intonational phrase in addition to the two traditional phrases ('major phrase' and 'minor phrase'), making intonational descriptions of Japanese excessively complicated. And second, the phonetic definition of the major phrase leads to a situation where the major phrase can be justified only by the surface F0 pattern and nothing else. That is, if we abandon the conception of the major phrase as the domain of downstep we will have no independent motivation for the intonational phrase other than the configuration of surface pitch patterns.

Meanwhile, if we choose the phonological interpretation, we will fall into no such difficulties. The only potential problem that faces us will be how we can account for the surface F0 pattern in Figure 4.1, or the fact that a given minor phrase is

phonetically realized at a higher F0 level than its preceding phrase within the same major phrase. As I shall show in Chapter Five, there is an independent reason for this seemingly anomalous phonetic pattern.

2.3. Summary

The discussion so far can be summarized in the following two points. First, the syntactic definition of the major phrase does not always square with the phonetic definition. There are cases where major syntactic boundaries do not induce major intonational phrase boundaries and, conversely, cases where (what looks like) a major intonational phrase boundary results from the syntactic string which obviously involves no major syntactic boundary. This suggests that we cannot generalize surface F0 patterns on the basis of the syntactic structure. It suggests, in other words, that intonational structure is not constrained by syntactic structure so severely as to permit us to draw a correspondence between a syntactic boundary and an intonational boundary.

A second conclusion that emerges from the foregoing discussion is that the phonetic definition and the phonological definition of the major phrase can contradict each other. This has two implications. First, it suggests that it is wrong to identify the intonational structure of utterances on the sole basis of the surface phonetic patterns they exhibit. In the case of the major phrase, it is wrong to posit a major phrase boundary between two given minor phrases simply because the second of them

happens to be realized at a higher pitch level than the first.

Similarly, the foregoing discussion casts doubt on approaches that identify the occurrence of intonational processes, including downstep, simply on the pitch pattern observable at the phonetic output. Surface pitch configurations result from the combination of more than one factor, and phonetic patterns cannot always be a reliable index of phonological processes. This point will be discussed in more depth in Chapter Five.

3. On Minimal Minor Phrases

As outlined in section 1.3, previous analyses of Japanese intonation such as McCawley (1968) and Poser (1984) adopt what I call the 'morpho-syntactic' definition of the minor phrase. They assume that certain sequences of morphemes form a basic intonational unit called 'minimal minor phrase,' or a unit which "must form a single minor phrase" (Poser, p.147), without breaking into more than one minor phrase. In this section, I will show evidence against the concept of 'minimal minor phrase' and challenge the hypothesis behind the concept. To do this, I will first present evidence that 'minimal minor phrase' can be realized in more than one minor phrase under certain conditions. In the second half of the section, I will consider the implications and consequences of this evidence for the modelling of Japanese intonation.

3.1. Evidence

The classes of phrases which McCawley (1968) and Poser (1984) cite as forming a 'minimal minor phrase' can be classified into the following three types in terms of their morphological composition. (24a) represents phrases consisting of a noun and one (or more) particle(s) while (24b) represents verbal or adjectival phrases made up of a verb or an adjective plus an auxiliary verb (or the like). (24c) involves the compound-like sequence of a verb and a so-called hozvo-doosi (literally 'auxiliary verb').^{<25>}

(24) a) Noun + Particles

e.g. na'oko-ga "Naoko-Nom"
ro'ndon-ma'de "London-to" = "to London"

b) Verbal/Adjectival Phrase: Verb + Auxiliary Verb

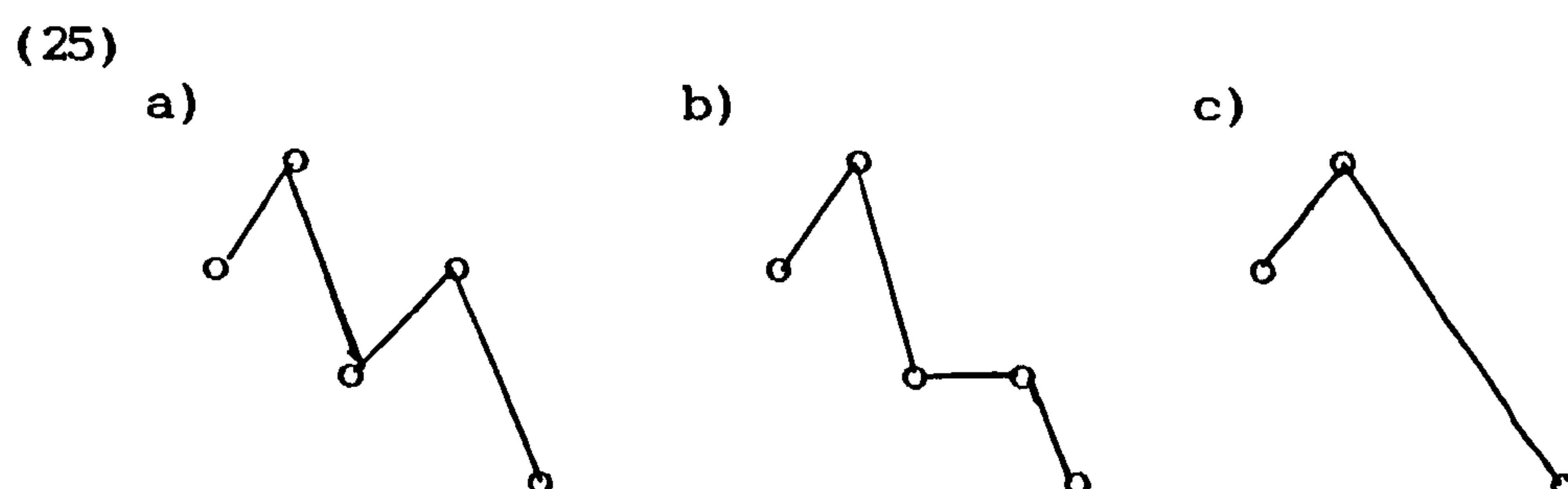
e.g. mi'ru-daro'o "will see"

c) Verbal Phrase: Verb + Verb

e.g. yo'nde mi'ru "read-see" = "try reading"
ka'ite iru "write-be" = "is writing"

The literature agrees that phrases of the type (24a) form "the class of sequences of morphemes that must form a single minor phrase" (Poser, p.147) while opinions differ as to whether (24b) and (24c) also form a minimal minor phrase. No matter where one draws a line between a single minimal minor phrase and the sequence of two minimal minor phrase, it is agreed that only one initial lowering and at most one accent (accentual fall) can be realized within a minor phrase at the phonetic output. In other words, the notion of 'minimal minor phrase' presupposes

that minimal minor phrases made up of two accented elements show only one phonetic pattern as shown in (25c), whereby the second element does not manifest its initial lowering or accent, and never show either of the two phonetic patterns in (25a) and (25b) in which the accent (and the initial lowering) of the second element is realized.



Notwithstanding this assumption, however, all the three F0 patterns in (25) are observed in my experimental data. Let us first consider the type of phrases in (24a). Dataset I and II contain eight sentences, some typical examples of which are illustrated in (26), in which the accented bimoraic particles ma'de "to, as far as, until" and yo'ri "from, in preference to" are attached to accented nouns. In the experiment, ten utterances of each sentence were analyzed, producing eighty utterances in all.

(26)

a) ro'oma-yo'ri mi'rano-e mukatta

"Rome-from" "Milan-to" "headed"
= "(she) headed for Milan from Rome"

b) kono ra'nnaa-yo'ri-mo ano ra'nnaa-no ho'o-ga asi'-ga
haya'i <26>

"this" "runner-than" "that" "runner-Gen" "side-Nom"
"leg-Nom" "fast"
= "That runner runs faster than this runner"

Not surprisingly, the F0 pattern in (25c) was most commonly observed in the data obtained (cf. Figure 4.7). It is worth emphasizing, however, that the same phrases showed the patterns in (25a) and (25b) alongside this pattern, as illustrated in Figures 4.5-4.6). Table 4 gives the summary of the frequencies with which these F0 patterns occurred.

Table 4 F0 Patterns and Frequencies

F0 Pattern	(25a)	(25b)	(25c)	Total
Frequency	7	7	66	80

Comparable observations can be made of the second type of phrases in (24). Dataset I and II include four test sentences of this type, as shown in (27), which yielded forty utterances for analysis. Like the type of phrases in (24a), these phrases showed free variation between the three F0 patterns in (25), as

illustrated in Figures 4.8–4.10. A detailed result is summarized in Table 5.

- (27) a) naomi-wa ayama'ru-daro'o
"Naomi-Topic" "apologize-will"
= "Naomi will apologize"
- b) naomi-wa ie'-ni ka'eru-yo'oda
"Naomi-Topic" "home-to" "return-look"
= "Naomi appears to return home"

Table 5 F0 Patterns and Frequencies

F0 Pattern	(25a)	(25b)	(25c)	Total
Frequency	9	7	24	40

The free variation between the three F0 patterns can also be observed for the phrase type in (24c). Dataset I and II contain three phrases of this type (cf. (28)) which yielded thirty utterances in all. Table 6 summarizes the frequencies with which the three phonetic patterns actually occurred (cf. Figures 4.11–4.13).

(28) a) ramune-o no'nde-mi'ru

"lemonade-Acc" "drink-see"
= "try drinking the lemonade"

b) mayumi-ga no'nde-mi'ru-ma'de

"Mayumi-Nom" "drink-see-till"
= "until Mayumi tries drinking (it)"

Table 6 F0 Patterns and Frequencies

F0 Pattern	(25a)	(25b)	(25c)	Total
Frequency	18	6	6	30

3.2. Summary and Theoretical Implications

The evidence presented in section 3.1 clearly shows that what seems to be the simplest form of phrase in Japanese shows variation between more than one F0 pattern. Whether one identifies the occurrence of a minor phrase by the realization of initial lowering or accentual fall, it is clear that more than one minor phrase actually result from the sequence of morphemes which have been characterized as 'minimal minor phrases.' To be more specific, particles (and morphemes analogous to them) can form a minor phrase independently of the lexical items to which they are attached. This finding has several implications and consequences for the modelling of Japanese intonation.

It implies, in the first place, that it is wrong to posit such a prosodic unit as 'minimal minor phrase' in the intonational system of Japanese. The fact that two minor phrases can result from 'minimal minor phrases' suggests that the concept is not just unnecessary but unjustifiable. In more general terms, this means that it is basically wrong to assume a priori that such and such a sequence of morphemes invariably forms a certain type of intonational unit while other sequences of morphemes do not. In other words, it casts doubt on the very hypothesis behind the concept of minimal minor phrase, that intonational categories can be defined so rigidly by the 'text,' or the syntactic and morphological structure of utterances. Intonational structure is not, after all, constrained by the text so severely as has been assumed.

A second implication of the evidence presented above is that it is necessary to revise the notions developed on the concept 'minimal minor phrase.' This yields particularly significant consequences for the notion of 'minor phrase formation,' which has been proposed on the assumption that 'minimal minor phrase' can be justified.

For example, it is obvious now that minor phrase formation is not a process which unifies two minimal minor phrases into one minor phrase. Insofar as the concept of 'minimal minor phrase' has to be abandoned, the intonational phrasing process has to be redefined as a rule which yields one minor phrase out of the sequence of words and morphemes from which more than one minor phrase can potentially be yielded. In other words, minor

phrase formation is part of the text-to-phonology mapping process which yields an intonational structure by making reference to the syntactic and morphological structure of utterances.

If this new definition of the intonational process is correct, it requires us to modify the intonational system of Japanese accordingly. In the traditional models of Japanese intonation, the intonational structure has been defined at two levels, before and after minor phrase formation takes place. That is, the strings of minimal minor phrases have been defined in an underlying intonational representation and the process of minor phrase formation has been assumed to derive a surface intonational representation by unifying two (or more) minimal minor phrases defined at this underlying level. Under the new definition of the phrasing process, we need not distinguish between these two levels of intonational representation any more, but it suffices to posit just one level, at the stage where minor phrase formation yields the string of minor phrases out of the string of words and morphemes. (29) compares these two different analyses in terms of the organization of the intonational system. (30) compares the same analyses in terms of the phonological derivation they assume for the intonational variation in (9).

(29) Intonational System

a) Traditional Intonational System

Underlying Intonational Representation



Surface Intonational Representation

b) Revised Intonational System

Syntactic/Morphological Representation



Intonational Representation

(30) Phonological Derivation

a) Traditional Account (= (11))

	(9a)	(9b)
Input to IP	akai hana	akai hana
IP	% akai % hana %	% akai % hana %
MPF	————	% akai hana %
TA	% LHH % LH %	% LHHH %

| | a kai ha na | a kai hana |

b) New Account

	(9a)	(9b)
Input to IP	akai hana	akai hana
MPF	% akai % hana %	% akai hana %
TA	% LHH % LH %	% LHHH %
<hr/>		
Output	a $\sqrt{\text{kai}}$ ha $\sqrt{\text{na}}$	a $\sqrt{\text{kai hana}}$

The evidence that 'minimal minor phrase' does not exist in Japanese provides another consequence for the process of minor phrase formation. Under the traditional accounts, it has been assumed that the phrasing process has an effect of unifying two (or more) minimal minor phrases while the unification of morphemes within minimal minor phrases has been treated as a different process. If there is no intonational unit comparable to the minimal minor phrase (MMP) in Japanese, we need not distinguish between these two processes, but it suffices to postulate just one phrasing process. To illustrate, the two processes shown in (31) — IP and MPF — can now be dealt with as a single process, as shown in (32). (amerika-kara "America-from" = "from America".)

(31)	<Within MMP>	<Between MMPs>
Input to IP	amerika kara	akai hana
IP	% amerika kara %	% akai % hana %
MPF	_____	% akai hana %
TA	% LHHH %	% LHHH %
<hr/>		
Output	a $\sqrt{\text{amerika kara}}$	a $\sqrt{\text{kai hana}}$

(32)	<Within MPP>	<Between MPPs>
Input to IP	amerika kara	akai hana
MPF (=IP)	% amerika kara %	% akai hana %
TA	% LHHH %	% LHHH %
<hr/>		
Output	a $\sqrt{\text{amerika kara}}$	a $\sqrt{\text{kai hana}}$

4. On Total Downstep

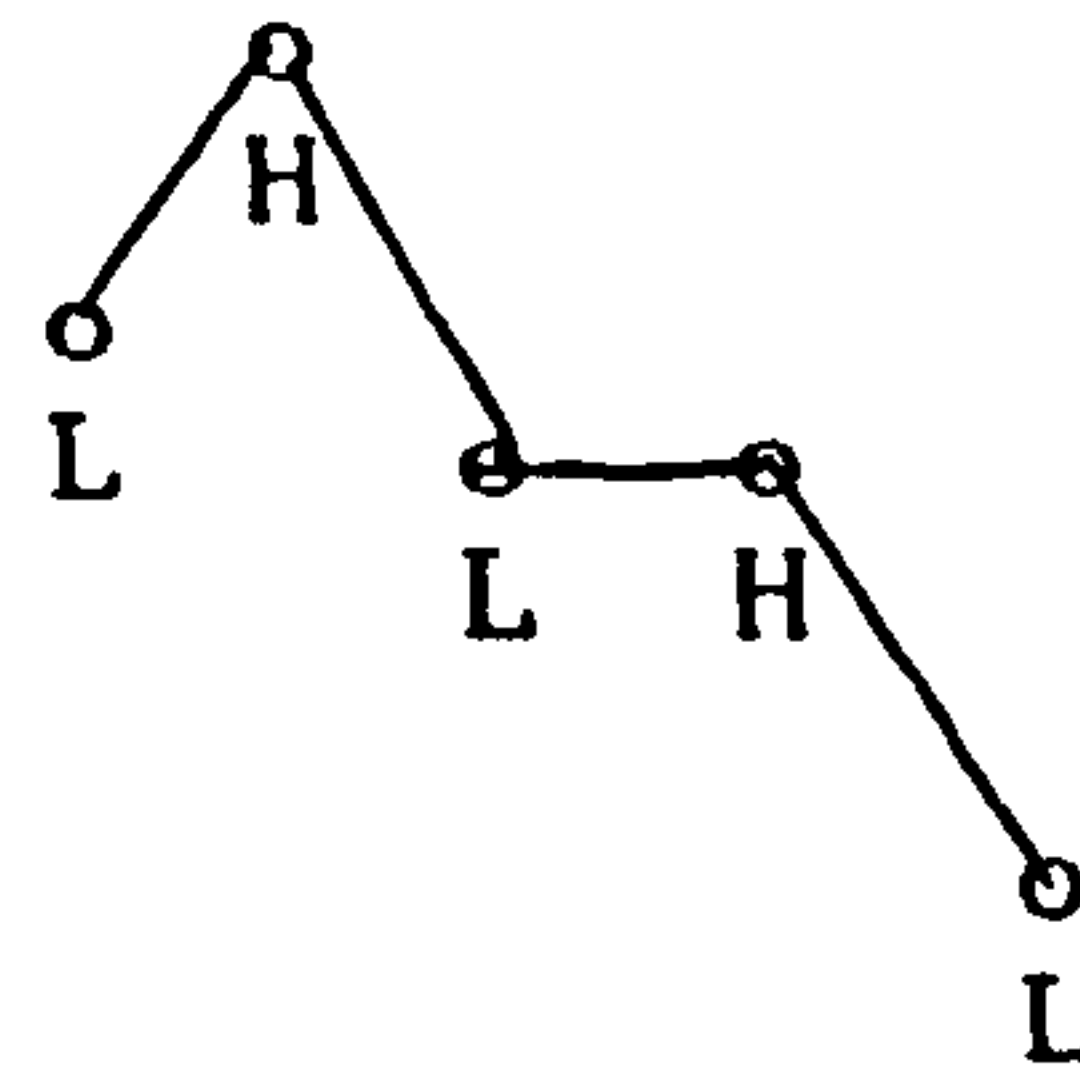
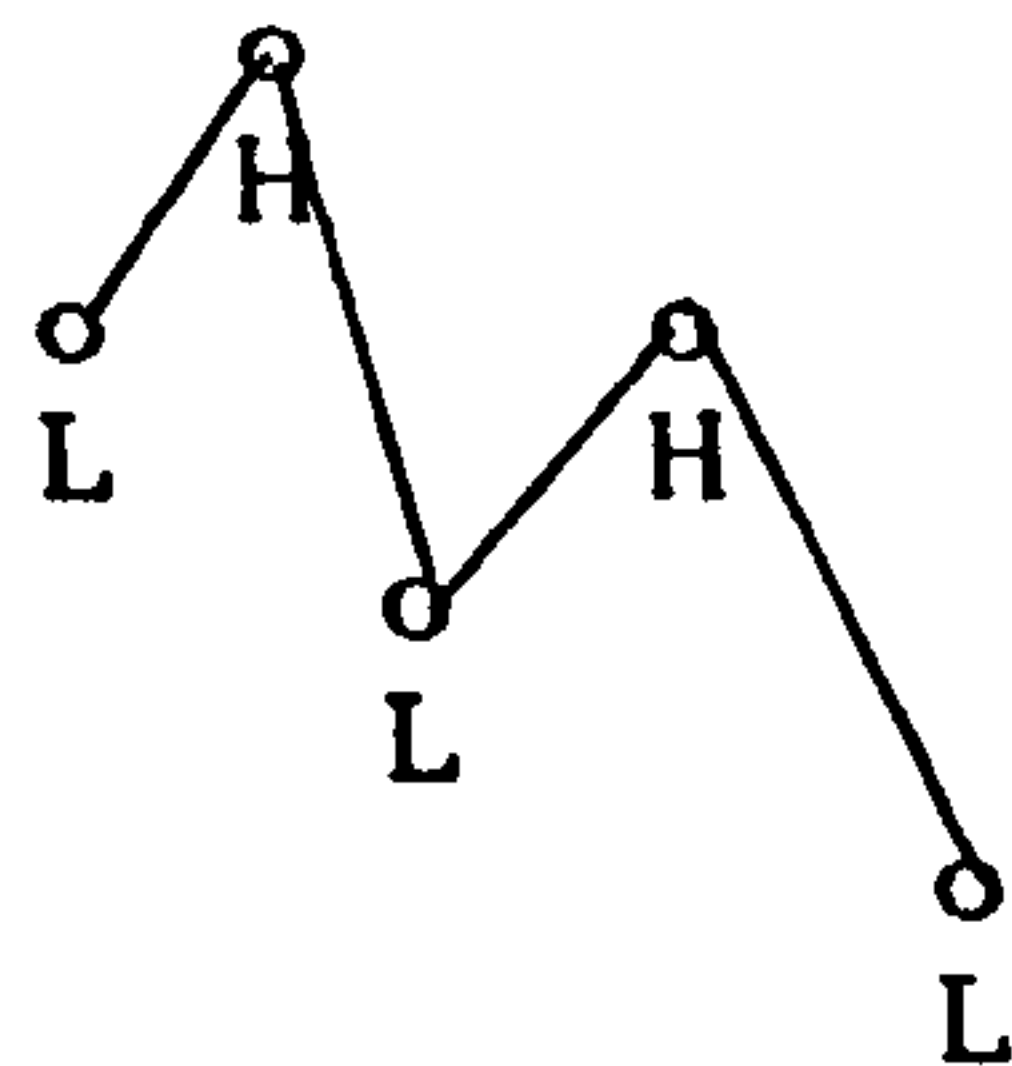
I showed in the preceding section that the morpho-syntactically defined intonational unit called 'minimal minor phrase' cannot be empirically justified in Japanese. In this section, I will demonstrate another fallacy concerning the minor intonational phrase by showing that total downstep does occur in Japanese. As outlined in section 1 above, total downstep refers to an F0 pattern as in (33b) in which initial lowering of the second minor phrase is totally eliminated in the sequence of two accented minor phrases. This F0 pattern contrasts with the F0

pattern in (33a), which represents the ordinary downstep pattern with the second minor phrase realizing both initial lowering and accentual fall clearly.

(33)

a) (= (25a))

b) (= (25b))



After showing evidence for total downstep, I will discuss the linguistic factors influencing the choice between the two F0 patterns or, in other words, the factors contributing to the elimination of the initial lowering of the second minor phrase. I will also consider the implications of the experimental evidence for the modelling of Japanese intonation.

4.1. Evidence

Total downstep is observed in various, though linguistically definable, contexts. For reasons of descriptive convenience, I will classify these contexts into two groups, (a) in the simplest syntactic phrases consisting of a lexical item plus auxiliary items (e.g. particles, hozyo-doosi), and (b) in the sequence of more than one such phrase. As I shall show shortly, the same linguistic factors control the occurrence of initial lowering in these two types of sequences.

4.1.1.

As mentioned in section 3 above, what appears to be the simplest form of syntactic phrases made up of two (or more) accented elements in Japanese show a variation between the three F0 patterns in (25). While the F0 pattern in (25b)(=(33b)) does not occur markedly often in comparison with the other two patterns, as summarized in Table 7, it is important to emphasize that it does actually occur in Japanese, contradicting the general belief.

Table 7 F0 Patterns and Frequencies

F0 Pattern Phrase Type	(25a)	(25b)	(25c)	Total
Noun + Particles	7	7	66	80
Verb + Aux. Verb	9	7	24	40
Verb + <u>hozvo-doosi</u>	18	6	6	30

The foregoing discussion may have given the impression that the three F0 patterns occur as free phonetic variation. This interpretation can be justified to a certain extent since one and the same speaker (subject) yields such a variation with one and the same sentence under apparently the same condition (cf. Figure 4.6 vs. Figures 4.5., 4.7; Figure 4.9 vs. Figures 4.8, 4.10; Figure 4.12 vs. Figures 4.11, 4.13). While this phonetic interpretation is essentially justifiable, a careful examination of the data suggests that the variation is not

entirely arbitrary. The data reveal at least three linguistic factors underlying the variation.

A first factor relates to the notion of 'PALM,' or the number of Low-toned morae in the post-accentual position. Generally speaking, initial lowering tends to be realized more often when the sequence of two accented elements involves a greater number of post-accentual Low-toned morae between them. In the two phrases in (34), which represents the phrase type in (24b) above, for instance, the second accented element in (34a), yo'oda, realizes initial lowering in six instances out of ten while the word in the same position in (34b), yo'oni, realizes initial lowering in no instance out of ten.

(34) a) PALM = 2 morae

(naomiwa utini) ka'eru-yo'oda

"Naomi-Top" "home-to" "return-look"
= "(Naomi) appears to return (home)"

b) PALM = 1 mora

(mayumiga) yo'mu-yo'oni ...

"Mayumi-Nom" "read-like"
= "... as (Mayumi) reads"

Tables 8 and 9 summarize the relation between the value of PALM and the occurrence of the initial lowering of the second element for the two types of phrases in (24a) and (24b) respectively. <27>

Table 8 PALM & IL: Phrase Type in (24a)

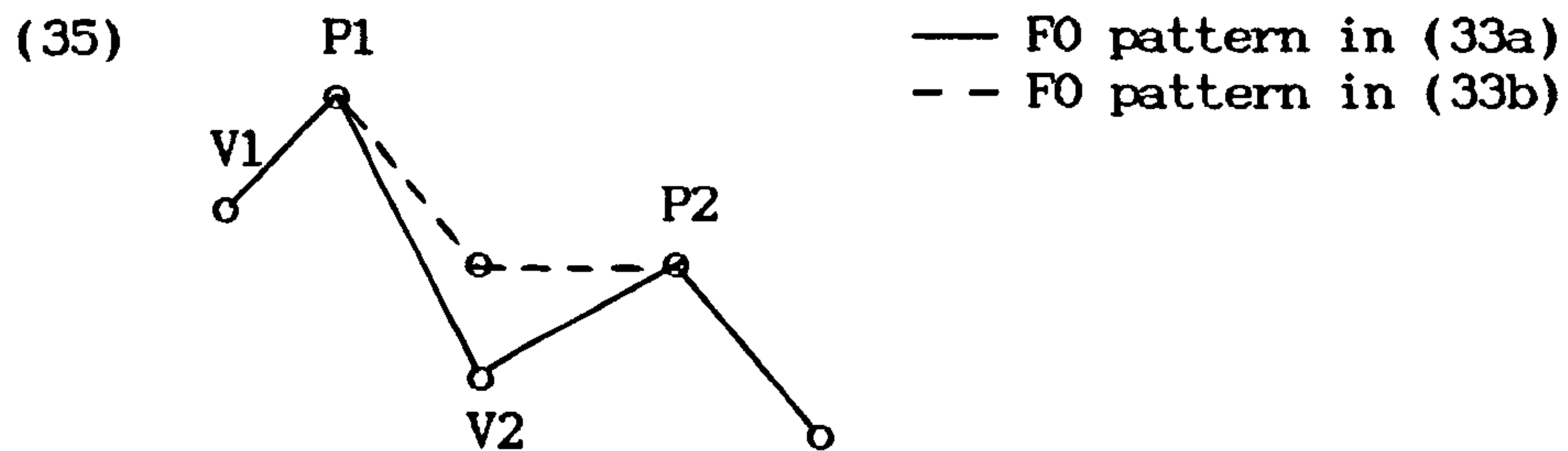
IL F0 Pattern PALM (mora)	[+IL] (25a)	[-IL] (25b) (25c)		Total
1	0	0	20	20
2	0	3	37	40
3	7	4	9	20

Table 9 PALM & IL: Phrase Type in (24b)

IL F0 Pattern PALM (mora)	[+IL] (25a)	[-IL] (25b) (25c)		Total
1	0	0	10	10
2	9	7	14	30

The apparent correlation between the value of PALM and the realization of initial lowering can be explained by the combination of two independently motivated principles. As shown in Chapter Three (section 1), pitch generally tends to fall further as the value of PALM increases, that is, as the sequence involves a greater number of Low-toned morae at the post-accentual position. In addition to this, F0 tends to rise at the onset of the second element in proportion to the degree of this preceding accentual fall (cf. Chapter Five, section 2.2 below). These two independent principles combined have an effect of decreasing the degree of initial lowering (initial F0 rise) of the second element as the sequence involves a smaller number of

post-accentual Low-toned morae over the two elements. (35) illustrates this in a time-normalized schematic picture.



A second factor contributing to the intonational variation in (33) is one of morphological complexity outlined in Chapter Three (section 3). Generally speaking, the second element tends to manifest initial lowering more often if it is itself followed by another element. In the two phrases in (36), for example, the initial lowering of the second element is realized in (36a) in seven instances out of ten while it is realized only in two instances out of ten in the case of (36b).

(36) a) Morphologically Complex Phrase

(kono) ra'nnaa-yo'ri-mo ...

"this" "runner~than-Null"
 = "... than (this) runner"

b) Morphologically Simplex Phrase

... o'oman-ma'de ...

"Oman-to" = "to Oman"

The correlation between the realization of initial lowering and the morphological complexity (MC) of the entire phrase is summarized in Tables 10 and 11 for the phrase types in (24a) and (24c) respectively. <29>

Table 10 MC & IL: Phrase Type in (24a)

IL FO Pattern MC	[+IL] (25a)	[-IL] (25b) (25c)		Total
Simplex	0	5	55	60
Complex	7	2	11	20

Table 11 MC & IL: Phrase Type in (24c)

IL FO Pattern MC	[+IL] (25a)	[-IL] (25b) (25c)		Total
simplex	0	5	5	10
complex	18	1	1	20

In addition to 'PALM' and the morphological complexity of the phrase involved, there is a third factor that obviously contributes to the realization (or elimination, seen conversely) of initial lowering. A glance at the result in Table 7 suggests that the rate at which initial lowering is realized in the second elements varies markedly from one phrase type to another. That is, initial lowering appears to be realized more readily in auxiliary verbs than in the particles attached to nouns, and even more so in hozvo-doosi, or the second member of the compound-like verbal sequences. Seen from a semantic viewpoint,

the second element tends to realize initial lowering more readily as it is semantically more independent of the element to which it is attached.

4.1.2

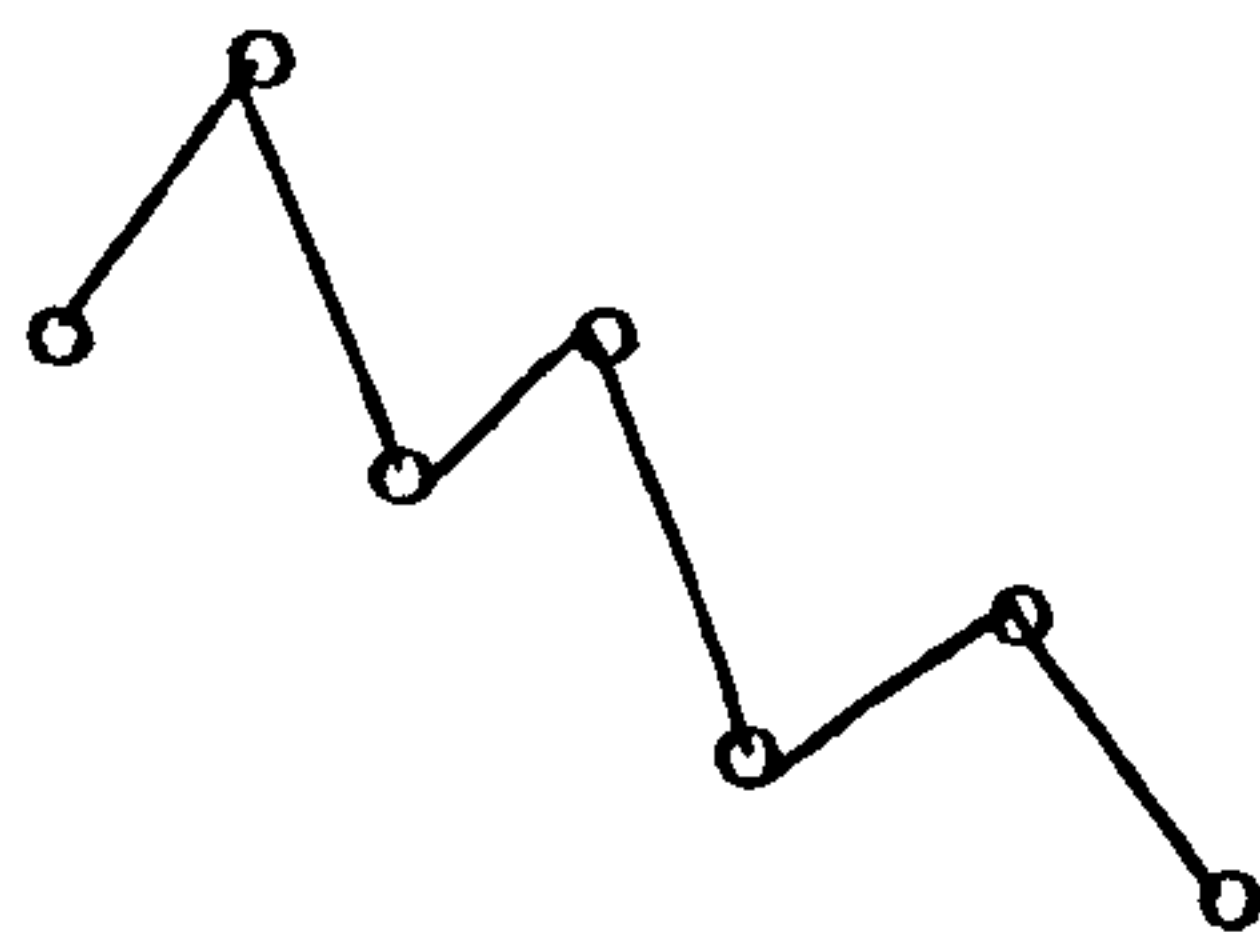
The F0 pattern characterizable as total downstep is observed between two syntactic phrases as well as within a single phrase. In my data, sequences of two accented syntactic phrases take either of the two F0 patterns illustrated in (33), the patterns in which the accent of the second element is clearly manifested. Of these two patterns, (33a) (= (25a)) is by far the more common in my data. In fact, phrases consisting of only two accented component phrases invariably take this pattern, fully realizing both the initial lowering and accent of the second component. To be more specific, Dataset V and VI contain eleven phrases of this accent type (from which 121 utterances were available for analysis), which all result in the pattern in (33a) as opposed to (33b) (cf. Figure 4.14).

Similarly, total downstep is not observed in right-branching phrases consisting solely of accented components. Phrases of this syntactic structure invariably yield an F0 pattern, as illustrated in Figure 4.15, in which both the initial lowering and accent of each component are clearly manifested.

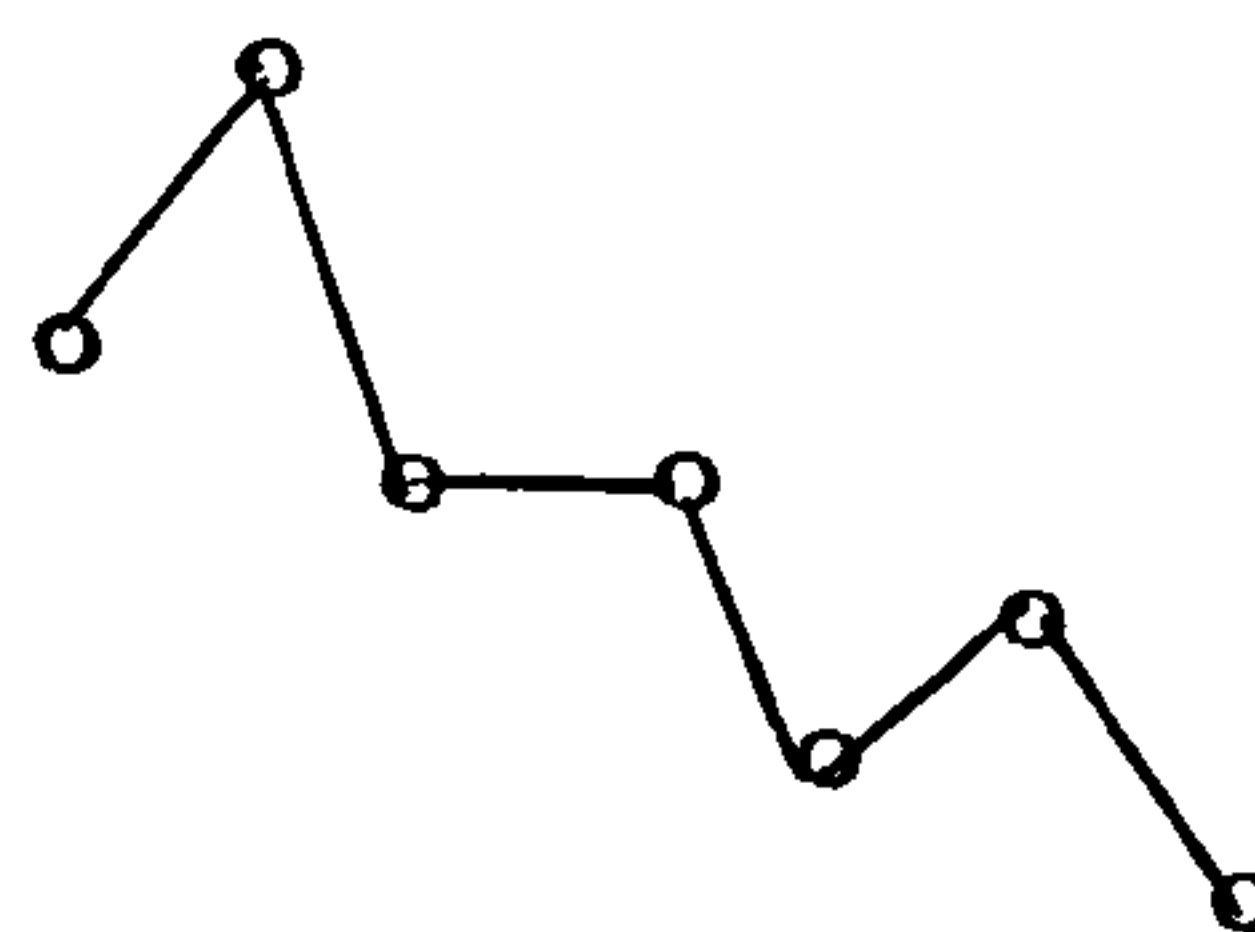
Meanwhile, total downstep is observed only in left-branching phrases, or better yet, between the first two accented components of this particular structure. In Dataset VII, for instance, the phrases in (38) yield the F0 pattern schematized in (37b) instead

of the pattern in (37a) (cf. Figure 4.16). And essentially the same pattern is found in the left-branching sentences in Dataset I, shown in (39) (cf. Figure 4.18).

(37) a)



b)



(38) Dataset VII

[[kowa'i me'no] oma'wari]

"fearful" "eye-Gen" "policeman"
= "a policeman with fearful eyes"

[[kuro'i ma'yuno] ira'nzin]

"black" "eyebrow-Gen" "Iranian"
= "an Iranian with black eyebrows"

(39) Dataset I

[[na'nio no'ndara] i'idesuka]^{<29>}

"what-Acc" "drink-if" "good-be-Q"
= "What would it be best to drink?"

[[na'nio a'ndara] i'idesuka]

"what-Acc" "knit-if" "good-be-Q"
= "What would it be best to knit?"

Having said that total downstep is observed in left-branching phrases, I must hasten to add that not all left-branching phrases show the pattern in (37b). On the contrary, most of the left-branching phrases in Dataset VII, including

those shown in (40), result in the pattern illustrated in (37a) (cf. Figure 4.17). Similarly, the test sentences in Dataset I more often yield the pattern in (37a) than in (37b) (cf. Figure 4.19). Table 12 gives the frequencies with which the two patterns actually occurred in each case.

(40) Dataset VII

a) [[na'mano u'nino] nio'i]

"raw" "oyster-Gen" "smell"
= "the smell of a raw oyster"

b) [[ao'i i'yaringuno] onna'noko]

"blue" "earring-Gen" "girl"
= "a girl wearing blue earrings"

Table 12 F0 Patterns and Frequencies

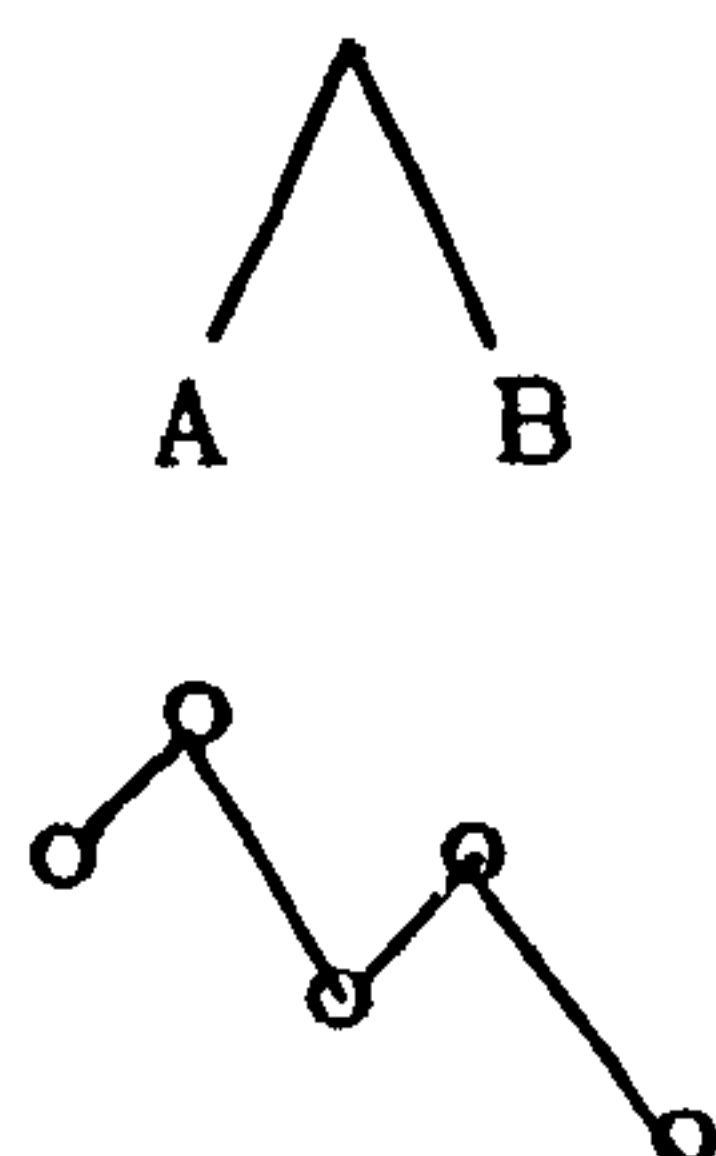
F0 Pattern	(37a)	(37b)	Total
Dataset VII	15	3	18
Dataset I	15	5	20

The fact that total downstep is observed in the left-branching construction and, for that matter, between the first two components in this particular construction suggests the fact that the same kind of morphological factor as we saw in section 4.1.1 (cf. Tables 10 and 11) influences the choice of the two intonational patterns in (37). That is, within a single syntactic phrase and between two syntactic phrases alike, the

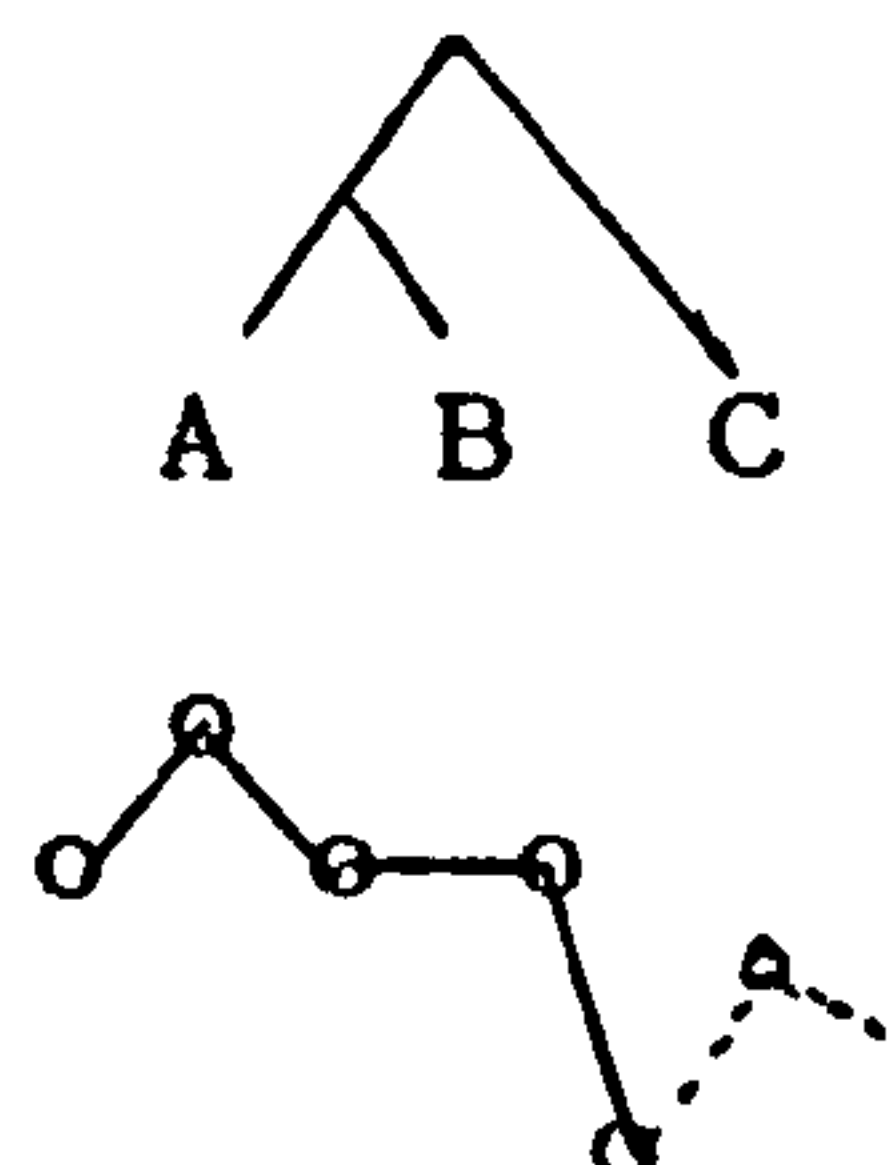
second element tends to realize its own initial lowering more readily when it is itself followed by another element than when it is not. This is illustrated in (41).

(41)

a)



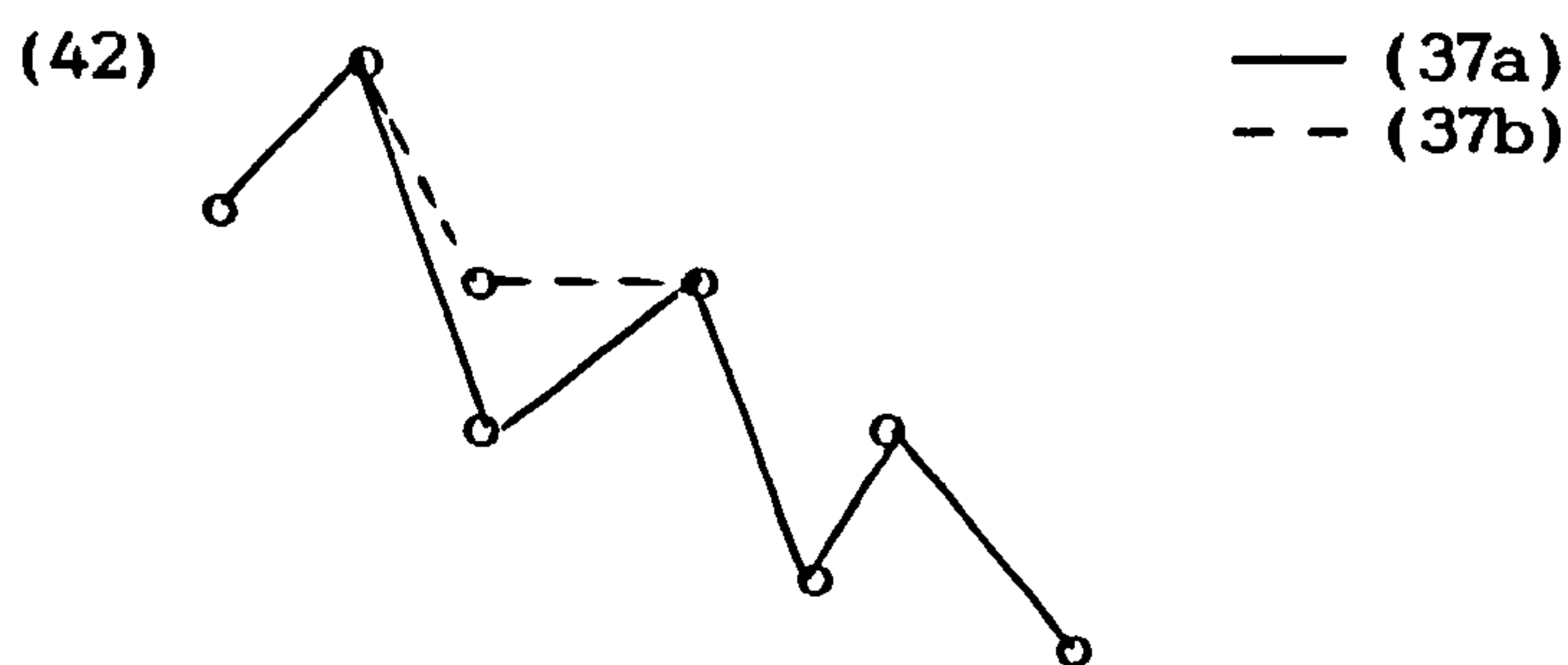
b)



A careful examination of the data suggests that the choice between the two F0 patterns in (37) is governed by some other general principles too. In Dataset VII, for instance, total downstep occurs in left-branching phrases whose first two components are tightly bound in meaning (e.g. (38)) while it is not observed in left-branching phrases in which the first two components form a loosely-bound semantic relationship (e.g. (40a)).^{<30>} This suggests that the realization of initial lowering is partly determined by the semantic relation between the two accented elements as well as by the syntactic configuration of the entire phrase in which they appear. This finding can be compared with the last finding in the preceding section, that the realization of initial lowering depends partly on the type of the phrase involved. That is, both in the case we saw in section 4.1.1 (cf. Table 7) and the case we are discussing now, downstep tends to occur more often as the second element is semantically more dependent on the element to which

it is attached.

A closer examination of the data from Dataset VII further suggests that the value of 'PALM' also contributes to the distribution of the two F0 patterns in (37). That is, the second component phrase seems more likely to have its own initial lowering as the number of post-accentual Low-toned morae becomes greater (e.g. (40b) vs. (38)). The relation between 'PALM' and the realization of initial lowering can be illustrated as in (42).



While the data from Dataset VII suggest that total downstep occurs due to the raising of the intervening valley between the two components, a closer look at the data from Dataset I further suggests that there are also cases where total downstep occurs due to the raising of the peak of the first element. As mentioned above, the sentences in Dataset I show a variation between the two F0 patterns. Figure 4.20 compares these two F0 patterns on an actual pitch scale on the basis of the mean F0 values of peaks and valleys. As shown in Table 13, the differences in the height of the first component, [Peak1], and in the intervening valley level, [Valley2], are both

statistically significant whereas the peak level of the second component, [Peak2], does not yield such a difference.

Table 13 Comparison of Two F0 Patterns in Dataset I
(All 18 df)

Parameter	F0 Pattern	Mean(Hz)	SD	t	P
[Peak1]	(37a)	187.7	6.55	2.182	<.05
	(37b)	193.2	6.69		
[Valley2]	(37a)	142.8	5.24	2.128	<.05
	(37b)	146.6	2.61		
[Peak2]	(37a)	147.3	4.40	0.430	>.20
	(37b)	146.6	2.61		

The result in Table 13 suggests that total downstep occurs when the peak of the first component is somehow realized at a relatively high F0 level. That is, if we take the pattern in (37a) as an unmarked pattern, total downstep can be attributed to the relatively higher value of the intervening valley, which in turn is attributable to the immediately preceding peak which has been raised for some reason (probably as a phonetic variation.)^{<31>}

A comparison of the data from Dataset I and those from Dataset II provides another interesting insight into the mechanism of initial lowering and total downstep. Dataset II includes the sentence shown in (43), which is different from the sentences in Dataset I, that is, those in (39), in involving an emphatic adverb ittai which serves to highlight the immediately preceding word na'nio "what".

(43) ittai na'nio no'ndara i'idesuka

"Emp" "what-Acc" "drink-if" "good-be-Q"
 = "What on earth would it be best to drink?"

While the sentences in (39) tend to choose the pattern in (37a), the sentence in (43) is more often realized in (37b) than in (37a), as can be seen from Table 14 (cf. Figures 4.21, 4.22). This suggests that the presence of an emphasis on a given accented element has an effect of eliminating the initial lowering of the following element.

Table 14 F0 Patterns and Frequencies

F0 Pattern Sentence	(37a)	(37b)	Total
(43)	2	8	10
(39)	15	5	20

The effect of a pragmatic emphasis on F0 contours is shown rather clearly in Figure 4.23, where the averaged F0 contour of the sentence in (43) is schematically compared with that of the sentences in (39). Table 15 summarizes the statistical comparison of the two averaged F0 contours.

Table 15 Comparison of (39) and (43)
(All 28 df)

Parameter	Sentence	Mean(Hz)	SD	t	P
[Peak1]	(39)	187.6	7.23	5.370	<.001
	(43)	199.2	4.54		
[Valley2]	(39)	143.8	4.95	0.439	>.20
	(43)	144.8	6.29		
[Peak2]	(39)	147.1	3.97	0.959	>.20
	(43)	145.0	6.32		

Table 15 clearly shows that the main difference between the two F0 contours lies in the height of the first minor phrase. This suggests that the presence of pragmatic emphasis on a given accented phrase boosts its pitch, which in turn leads to the elimination of the initial lowering of the immediately following minor phrase.

4.2. Summary and Theoretical Implications

The foregoing discussion can be summarized in the following three points. First, the F0 pattern characterizable as total downstep occurs in Japanese both within a single syntactic phrase and between two phrases. Second, the variation between total downstep and the ordinary configuration of downstep (that is, (33a)) can be viewed, at least in part, as a phonetic variation since the two F0 patterns result from one and the same phrase produced by one and the same speaker under apparently the same condition. Third, while the variation between the two F0 patterns can be seen as a phonetic variation to some extent, it is also controlled by linguistic factors to a certain extent. Total downstep tends to occur (that is, the initial lowering of

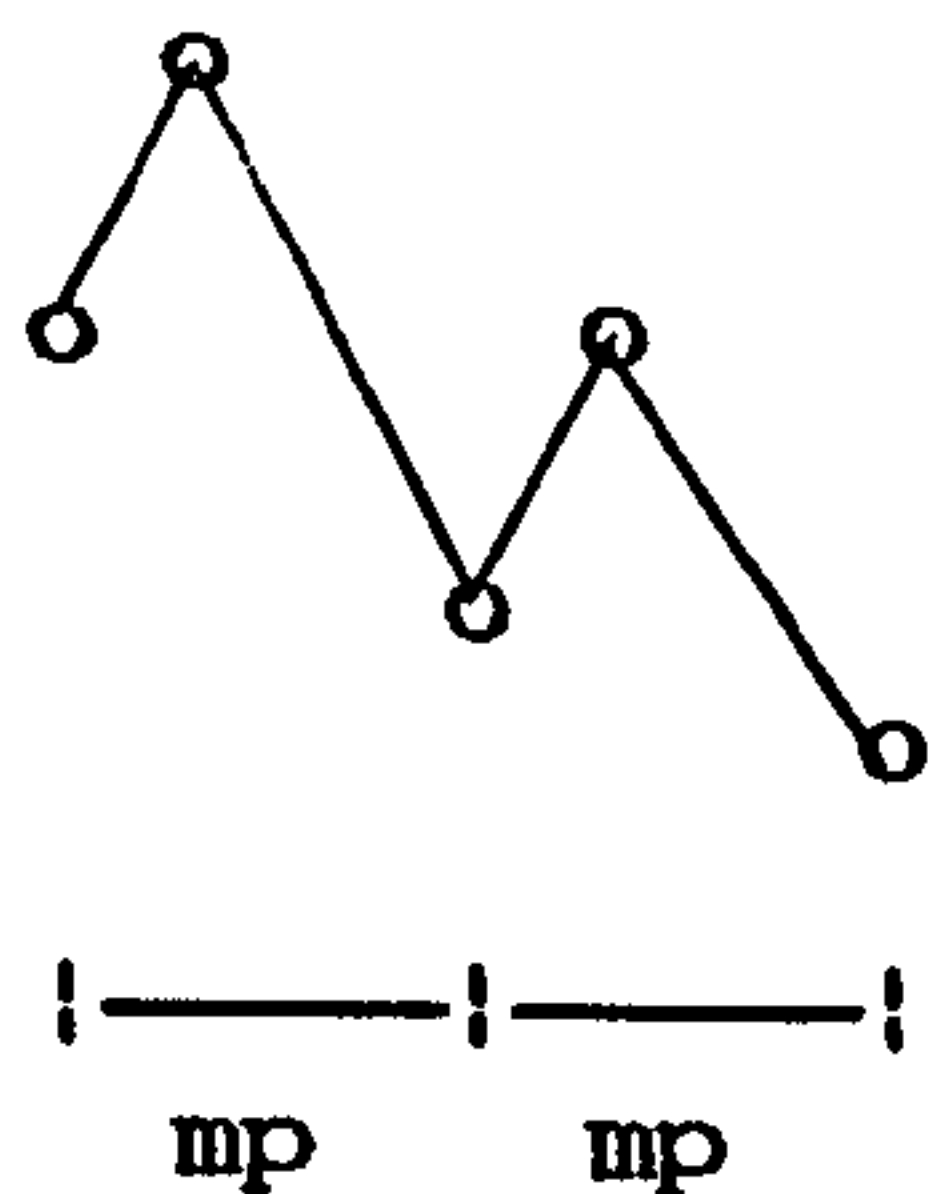
the second element tends to be eliminated) more often (i) as the number of post-accentual Low-toned morae (PALM) over the two elements gets smaller (Phonological Factor); (ii) when the second element is followed by another element within the same phrase (Morpho-syntactic Factor), and (iii) as the extent of the semantic fusion between the two elements becomes greater (Semantic Factor). In addition to these linguistic factors, the occurrence of total downstep appears to be caused by the presence of pragmatic emphasis on the first element (Pragmatic Factor).

Although in my data total downstep is observed only when most of these conditions are met, this must not be taken as implying that they represent the absolute conditions for the total elimination of initial lowering. It will be perfectly possible that one and the same phrase or sentence should show a considerable variation in pitch patterns from one speaker to another, and even from one utterance to another within the same speaker depending on various linguistic and para-linguistic factors. It must be emphasized, however, that total downstep does actually occur in Japanese, and that its occurrence is conditioned by linguistic factors to a considerable extent.

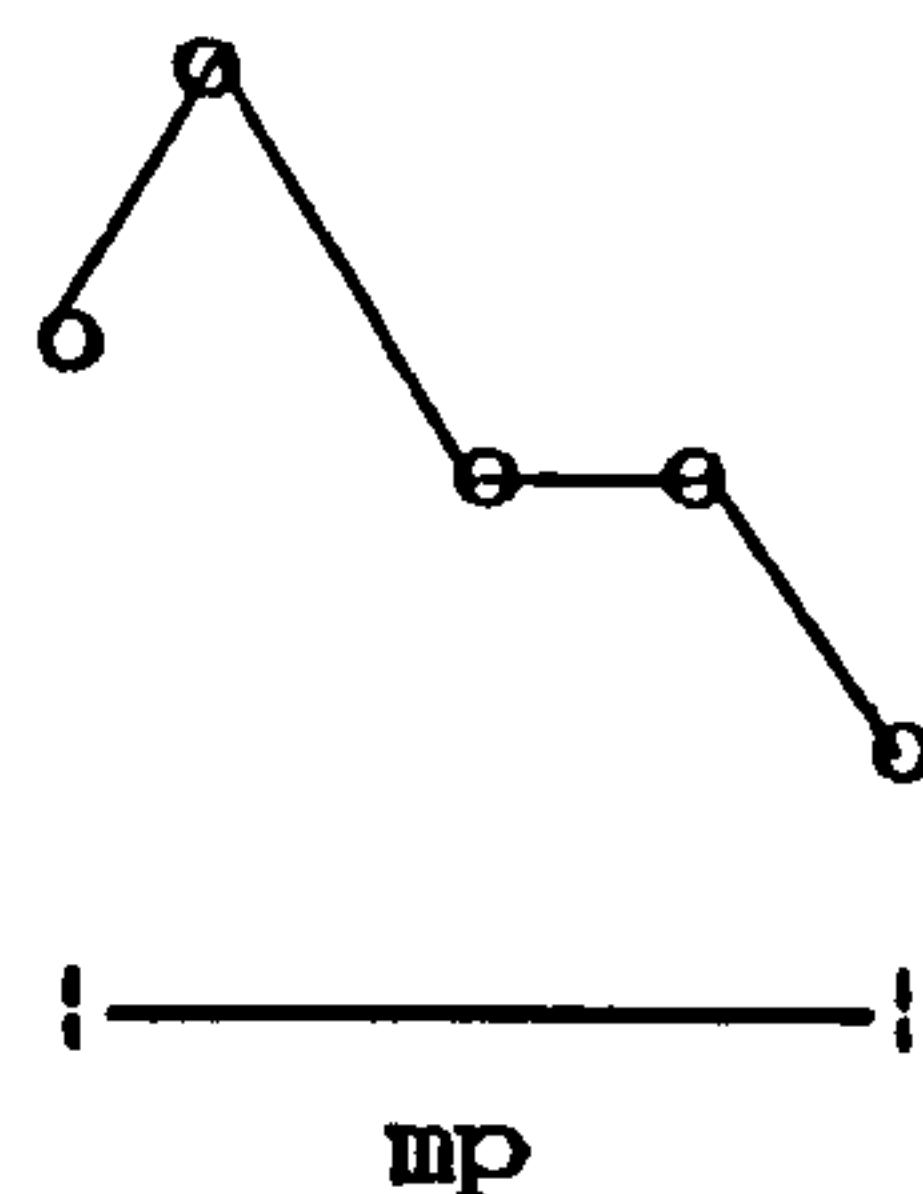
The fact that total downstep actually occurs in Japanese has two major implications for the modelling of Japanese intonation. First, the very fact that such F0 pattern does exist in Japanese implies that the realization of initial lowering is independent of the realization of accent. That is, the generalization that every minor phrase involves one initial lowering and at most one realized accent is obviously misleading.

This requires us to reconsider the definition of 'minor phrase.' If we define the intonational phrase as a unit which involves one and only one (realized) initial lowering, then we must admit the possibility of a minor phrase involving more than one realized accent. If, on the other hand, the phrase is defined as a unit in which at most one accent is realized, then we must admit the existence of a minor phrase with no initial lowering. (44) and (45) illustrate these two lines of definition.

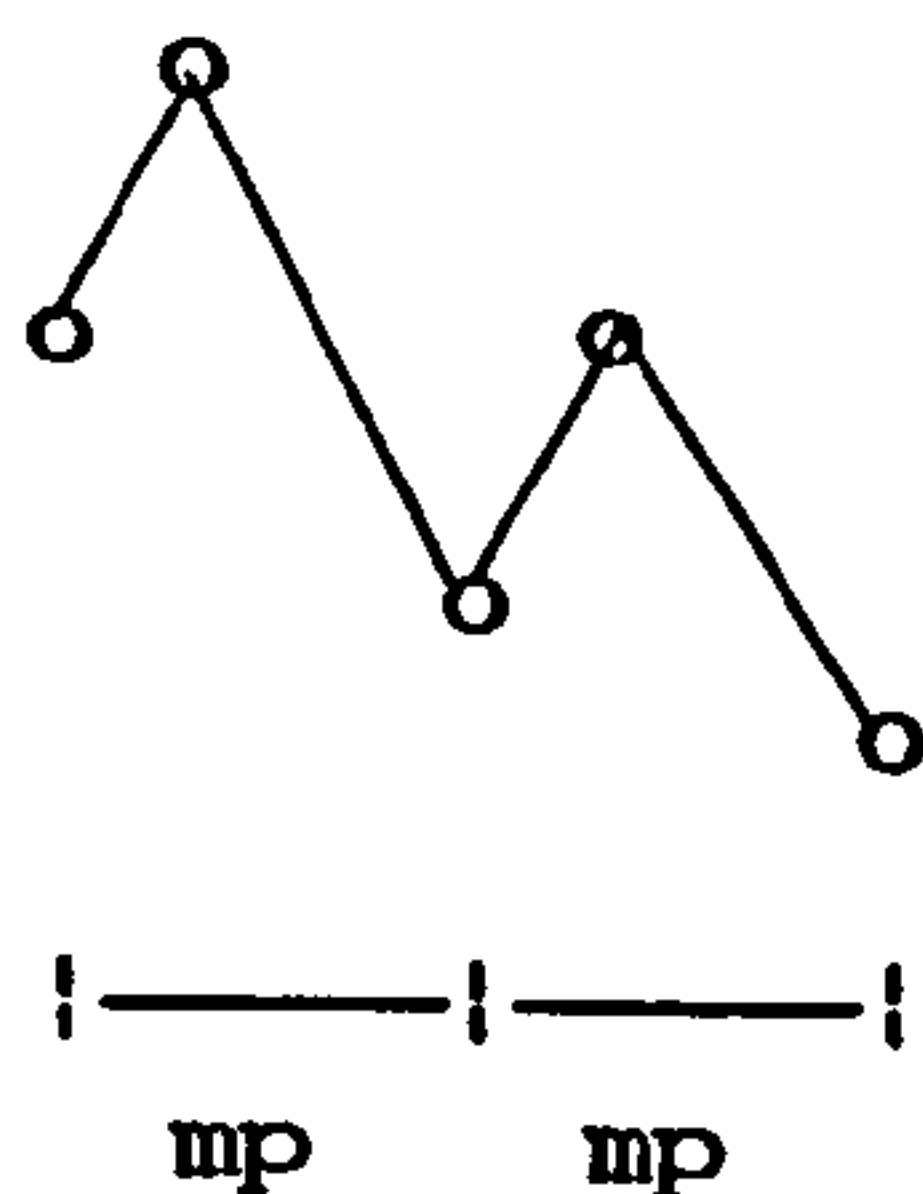
(44) a) (= (33a))



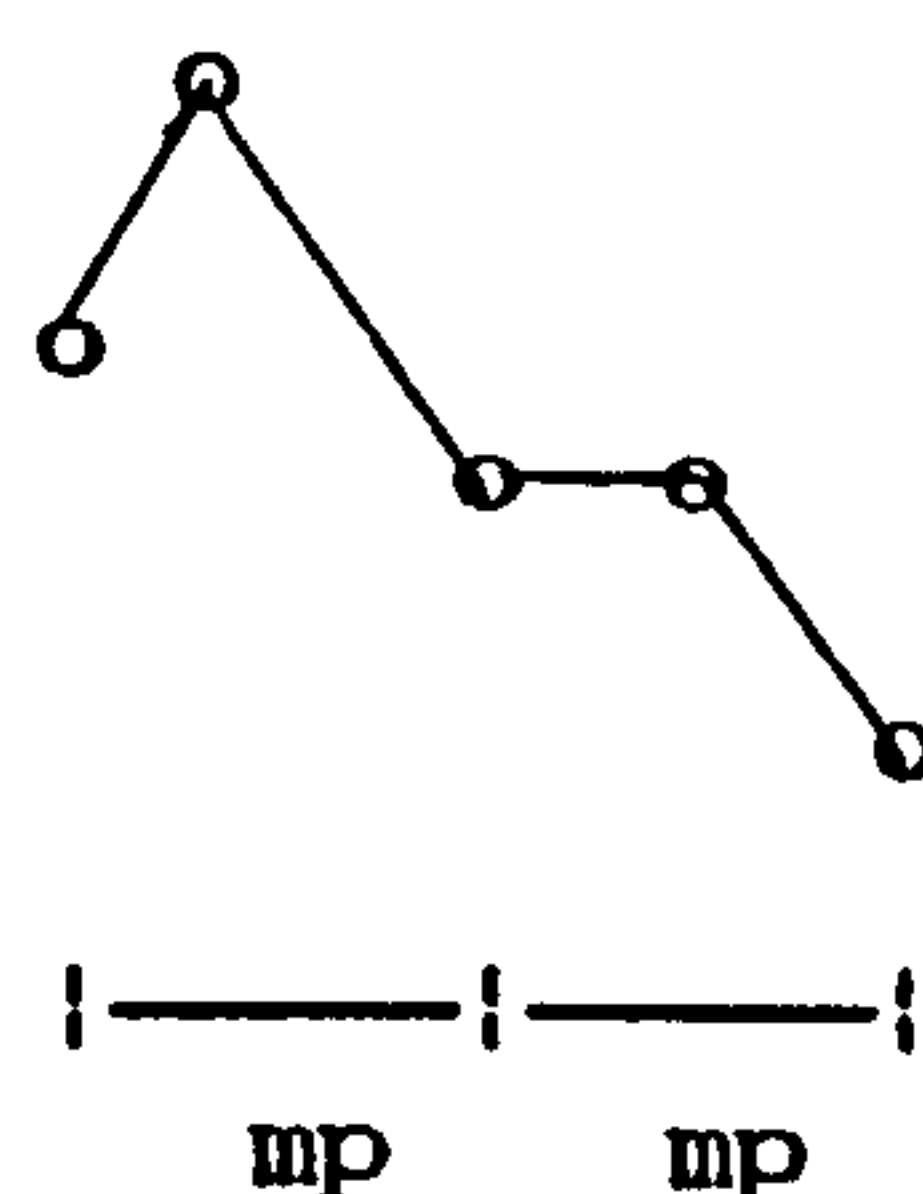
b) (= (33b))



(45) a) (= (33a))



b) (= (33b))



Of these two lines of definition, I am inclined to support the second definition for the following two reasons. One reason comes from the general belief that total downstep represents one

case of downstep, a case in which the initial lowering of the second element has been 'masked' or eliminated at the phonetic level by various factors (and as free phonetic variation). Since downstep itself is an interacting process between two minor phrases, total downstep must be defined between two minor phrases, not within a single minor phrase. The other reason I favor the definition in (45) comes from my observation that the phonetic realization of initial lowering is subject to various linguistic factors. As will be shown in the next section, the extent to which F0 rises as the realization of initial lowering varies considerably due to many interacting linguistic factors. If so, it will not be unrealistic to suppose that initial lowering can be totally eliminated at the phonetic level under certain linguistically definable contexts.

5. On Initial Lowering

In the preceding section I showed the evidence for total downstep and explored the linguistic factors contributing to the phonetic elimination of initial lowering. In this last section on the minor phrase, I will summarize the factors and principles that influence the extent to which F0 rises when initial lowering is realized.

Looking through my experimental data from the ten datasets, I can find at least four such factors. One of them is the effect of accent discussed in Chapter Three (section 2). That is, other things being equal, accented minor phrases show a greater degree of initial lowering than unaccented counterparts as a manifestation of accentual boost. To put it another way, this means that surface initial lowering involves two factors, one of true initial lowering and an effect of accentual boost. Figure 4.24 illustrates this.

A second linguistic factor influencing the degree of initial lowering at the surface phonetic level is the phonological structure of the entire phrase in which a given minor phrase is put. In the sequence of an accented minor phrase followed by another minor phrase, the extent to which F0 rises at the onset of the second minor phrase varies greatly depending on the degree to which pitch drops as a realization of accent of the first phrase. As will be discussed in the next chapter (section 2.2), these two phonetic parameters covary in such a way that a greater degree of accentual fall induces a greater degree of

initial lowering. Since the degree of accentual fall varies considerably according to the number of the post-accentual Low-toned morae (PALM) over the two minor phrases, it can be said that the surface initial lowering of a given minor phrase reflects the phonological structure of the entire phrase of which it forms a second component. In other words, the extent of the surface initial lowering of a given minor phrase is determined both by its phonological structure and that of the minor phrase which immediately precedes it.

A third linguistic factor contributing to the increase of surface initial lowering of minor phrases is the syntactic configuration of the entire phrase in which they are put. As will be shown in the next chapter (sections 3 and 4), right-branching phrases differ significantly from left-branching phrases in the height of the second minor phrase. That is, in the sequence of minor phrases in which the first is accented, the second minor phrase is realized at a substantially higher pitch level in right-branching phrases than in left-branching phrases. This extra boost in pitch, which I call "metrical boost," has an effect of increasing the degree of initial lowering in the second minor phrase in the right-branching construction in comparison with the left-branching counterpart.

While the three factors that have been outlined all relate to accented minor phrases in some way or other, sequences of unaccented minor phrases are also subject to certain factors in regard to the realization of initial lowering. One factor that

is in evidence in my experimental data is the location of the minor phrase within the entire sentence of which it forms a component. Dataset IV includes the four phrases shown in (46) which are all made up of four unaccented words or simplex phrases. These four phrases involve different syntactic structures and, accordingly, yield different phrasing patterns, as illustrated in (47) (cf. Figures 4.25-4.28)

(46) Dataset IV

- a) [[naomino aneno][marui yunomi]
 "Naomi-Gen" "sister-Gen" "round" "teacup"
 = "Naomi's sister's round teacup"
- b) [[naomino [ueno aneno]] yunomi]
 "Naomi-Gen" "upper-Gen" "sister-Gen" "teacup"
 = "Naomi's eldest sister's teacup"
- c) [naomino [[umeno irono] yunomi]]
 "Naomi-Gen" "plum-Gen" "color-Gen" "teacup"
 = "Naomi's plum-colored teacup"
- d) [naomino [omoi [marui yunomi]]]
 "Naomi-Gen" "heavy" "round" "teacup"
 = "Naomi's heavy round teacup"

- (47) a) na√omino aneno ma√rui yunomi
 b) na√omino u√eno aneno yunomi
 c) na√omino u√meno irono yunomi
 d) na√omino o√moi ma√rui yunomi

Notwithstanding these differences in intonational phrasing, the surface realization of initial lowering is controlled by two principles which are independent of the phrasing patterns.

First, the degree of initial lowering decreases during the course of utterances such that the second minor phrase shows a smaller degree of initial lowering than the first minor phrase, and the third minor phrase shows an even smaller degree of initial lowering.^{<32>} This can be seen from the data in Table 16, which summarizes the mean F0 values of eleven utterances of each phrase, as well as from Figure 4.29, which schematizes the F0 contour of the phrase in (46d). ([IL-n] denotes the surface initial lowering of the n-th minor phrase. Figures in brackets represent standard deviation).

Table 16 Dataset IV: Degree of Initial Lowering (Hz)

Phrase	[IL 1]	[IL 2]	[IL 3]
(46a)	23.9 (5.05)	12.9 (1.97)	—
(46b)	22.8 (4.92)	12.0 (3.35)	—
(46c)	23.2 (5.36)	11.0 (5.18)	—
(46d)	26.6 (4.03)	11.5 (3.21)	6.1 (2.91)

Another principle contributing to the degree of initial lowering in the four phrases in (46) is that an n-th minor phrase shows a constant degree of initial lowering across different phrases, irrespective of the differences in intonational phrasing and the phonological length of the preceding minor phrases. As for the initial lowering of the first minor phrase, the greatest difference is observed between (46b) and (46d), but

it is not statistically significant: ($P(t=1.979, df=20) > .05$). Similarly, the greatest difference in the initial lowering of the second minor phrase, which is found between (46a) and (46d), is not statistically significant either: ($P(t=1.239, df=20) > .20$).

To sum up, it can be concluded that the phonetic realization of initial lowering is influenced by many factors from the accentedness of the minor phrase concerned to the syntactic structure of the entire sentence in which the minor phrase is put. In other words, the surface initial lowering as observable at the phonetic output of speech is not an all-or-nothing phenomenon but an n-ary phenomenon to which many independent factors interactively contribute.

6. On Minor Phrase Formation

Having considered various problems regarding the two types of intonational phrases in Japanese, I will now address the process of minor phrase formation (MPF), another controversial topic in the research on Japanese intonation. In this section, I will first challenge the traditional definition of this intonational phrasing process. I will argue that MPF is part of the syntax-phonology mapping process which yields one intonational phrase out of the sequence of words which can potentially yield more than one intonational phrase.

After justifying this new view of MPF, I will focus on the conditions on intonational phrasing, or the linguistic factors which influence the choice of intonational phrasing.

In sections 6.2 and 6.3, I will present experimental evidence to solve the traditional controversies concerning the accentual and syntactic conditions on the phrasing process (cf. section 1.4). As for the accentual condition, I will show that it is the Fujisaki-Poser hypothesis and not the hypothesis held by McCawley and others that makes the correct predictions. As for the syntactic condition, I will show that the branching condition which Fujisaki suggests accounts for the intonational phrasing patterns in Japanese while the 'proper syntactic analysis' as proposed by McCawley and Poser fails.

In the last section (section 6.4), I will propose a third condition on MPF which I call the 'rhythmic condition.' Since this condition, like the branching condition to be discussed in section 6.3, is essentially the same as the condition which constrains the process of accentual phrasing (cf. Chapter Two), I suggest that these conditions represent abstract principles that constrain the phonological processes in Japanese in general.

6.1. MPF Redefined

In section 1.4, I analyzed the traditional definition of MPF into the following three assumptions: (i) that MPF is an optional process; (ii) that MPF is an intonational phrasing process; (iii) MPF is a process whereby two (minimal) minor phrases are combined to form one minor phrase. Of these three assumptions underlying the traditional definition of the intonational process, I support the first two assumptions, that is, the

hypothesis that MPF is an optional process of intonational phrasing. As for the third assumption, however, I refute it in favor of the interpretation of MPF as a kind of syntax-phonology mapping process whereby strings of syntactic/morphological units are organized into an intonational structure. To be more specific, I propose to redefine the intonational process as a process which yields a single minor phrase out of the string of syntactic/morphological units (i.e. morphemes and words) from which more than one minor phrase can potentially be yielded. (48) illustrates the phonological derivation under this definition.

(48) (= (30b)) Derivation Under the New Definition

	(9a)	(9b)
Input to IP	akai hana	akai hana
MPF	% akai hana %	% akai % hana %
TA	% LHH HH %	% LHH % LH %
Phonetic output	<u>a</u> <u>kai hana</u>	<u>a</u> <u>kai</u> <u>ha</u> <u>na</u>

The reasons I prefer this new definition of MPF to the traditional definition are two-fold. First, the traditional definition of MPF introduces an unnecessary complexity into the system of phonological derivation in Japanese. Under the traditional analyses, the intonational representation is defined at two levels, linked by MPF (cf. (11), (30a)). That is, an underlying intonational representation is defined prior to MPF, and a surface intonational representation is defined at the output of MPF. Under the new definition I propose, MPF yields the string of minor phrases directly from the string of

syntactic/morphological units. There is no need, therefore, to differentiate two levels of intonational representation (intonational phrasing), but it suffices to define intonational representation at just one level, where the effects of MPF are defined.

A second and more crucial reason I prefer the new definition to the traditional one is related to the claim I made before (cf. section 3 above and Chapter Three, section 3), that the notion of 'minimal minor phrase' and the hypothesis underlying it cannot be empirically justified. As I pointed out just above, the traditional definition of MPF presupposes the existence of an underlying intonational representation, in which 'minimal minor phrase' forms a basic unit. As I have shown in section 3 above, however, it is empirically wrong to posit such a prosodic unit as 'minimal minor phrase', or to assume a priori that such and such sequences of morphemes must always form one minor phrase. Insofar as the notion of 'minimal minor phrase' is unjustified, the traditional definition of MPF loses its very basis.

6.2. Accentual Condition on MPF

We saw in section 1.4. above that the literature shows a striking disagreement on the role of word accent in intonational phrasing. Fujisaki & Sudo (1971) and Poser (1984), on the one hand, assume that sequences of two elements are bound to undergo MPF if the left-hand member is unaccented. McCawley (1968), Hayata (1969) and Kohno (1980), on the other hand, claim that MPF

takes place if either of the two elements is unaccented. To illustrate this with the four accentual combinations given in (49) below, Fujisaki & Sudo and Poser draw a line between the first two patterns and the last two patterns while McCawley, Hayata and Kohno group the last three patterns as a natural class, assuming that the sequence in (49b) is as likely to form one minor phrase as the sequence in (49c).

- (49) a) [+A,+A] uma'i me'ron "tasty melon"
 b) [+A,-A] uma'i oimo "tasty potato"
 c) [-A,+A] amai me'ron "sweet melon"
 d) [-A,-A] amai oimo "sweet potato"

A careful examination of my experimental data reveals two lines of evidence for the Fujisaki-Poser assumption in preference to the hypothesis proposed by McCawley and others. The first piece of evidence concerns the frequency with which the second element exhibits initial lowering at the phonetic level in the sequence of two elements as in (49). Datasets V and VI consist of many phrases made up of two words or simplex phrases like those in (49). The data from these datasets show that sequences of the accent type in (49b) exhibit an F0 rise at the onset of the second element far more often than sequences of the accent in (49c). In fact, all the 77 instances of the (49b)-type test phrases show a clear F0 rise, with the average of 11.5 Hz, at the position in question (cf. Figure 4.30), whereas a majority of the instances of the (49c)-type phrases show no comparable F0 rise (cf. Figure 4.31). This result is summarized

in Table 17, where [+IL2] and [-IL2] indicate whether or not the second element showed an initial rise respectively.

Table 17 Dataset V & VI: Occurrence of Surface IL

Accent type	[+IL2]	[-IL2]	Total
(49a) [+A,+A]	121	0	121
(49b) [+A,-A]	77	0	77
(49c) [-A,+A]	25	30	55
(49d) [-A,-A]	17	27	44

Comparable observations can also be made about the data from Dataset VII, which consist of test phrases made up of three words or simplex phrases. As illustrated in Table 18, the second element invariably exhibits a clear initial F0 rise when following an accented element whereas it does not always do so when following an unaccented element.

Table 18 Dataset VII: Occurrence of Surface IL

Accent type	[+IL2]	[-IL2]	Total
<2/3a> [+A,+A,+A]	18	0	18
<2/3c> [+A,-A,+A]	21	0	21
<2/3b> [-A,+A,+A]	11	12	23
<2/3d> [-A,-A,+A]	4	20	24

The results summarized in Tables 17 and 18 clearly show that sequences of an accented element plus an unaccented element, i.e. (49b), form a natural class with sequences of two accented elements, i.e. (49a), whereas the other two accent types form another natural class on their own.

As I claimed from Section 3 through section 5, the extent to which F0 rises at the onset of a phrase varies considerably depending on a variety of factors, and it is not therefore precisely adequate to define the occurrence of minor phrases (and their boundaries) simply on the existence of an phrase-initial F0 rise observable at the phonetic output. However, the fact that a marked difference results as to the occurrence of the phrase-initial F0 rise under the same condition can be taken as evidence that words and phrases, accented and unaccented alike, tend to form an independent minor phrase when following an accented element, but not when following an unaccented element.

The other line of evidence for the Fujisaki-Poser account of

the accentual influence on MPF comes from the process which I term "pre-accentual boost (PreAB)." I pointed out in Chapter Three (section 2) that accented words and phrases have higher pitch than unaccented counterparts. Although I concentrated there on the effect of accent-induced F0 boost (Accentual Boost) within a given word or phrase, accent can exert its boosting effect onto the preceding word over what looks like a minor phrase boundary.

Dataset VI includes the four phrases in (50) and has yielded eleven utterances for each of them.

- (50) a) uma'i nomi'mono "tasty drink"
b) uma'i yamaimo "tasty yam"
c) amai nomi'mono "sweet drink"
d) amai yamaimo "sweet yam"

Of these, nine tokens of (50c) and eight tokens of (50d) showed an F0 rise ranging between 2 Hz and 12 Hz at the onset of the second component (cf. Figures 4.32 and 4.33). I compared the two phrases in regard to these utterances. As can be seen from Figure 4.36, these two phrases show a difference not only in [Valley2] and [Peak2] but in [Peak1] as well. And this difference is statistically significant, as shown in Table 19.

Table 19 Dataset VI (All 15 df)

Parameter	Accent type	Mean(Hz)	SD	t	P
[Valley1]	(50c)	147.4	3.40	1.700	>.10
	(50d)	144.0	4.66		
[Peak1]	(50c)	155.9	2.80	2.381	<.05
	(50d)	151.4	4.66		
[Valley2]	(50c)	151.6	2.92	3.319	<.01
	(50d)	143.9	5.94		
[Peak2]	(50c)	159.0	3.12	5.758	<.001
	(50d)	147.6	4.78		

Although the difference in [Valley1] (that is, the onset value of the first component) is not statistically significant, it is clear that the accent in the second word exerts its boosting effect on [Peak1], or the peak of the preceding word. In other words, the effect of accentual boost spreads up to the high stretch of the preceding word over the apparent minor phrase boundary.

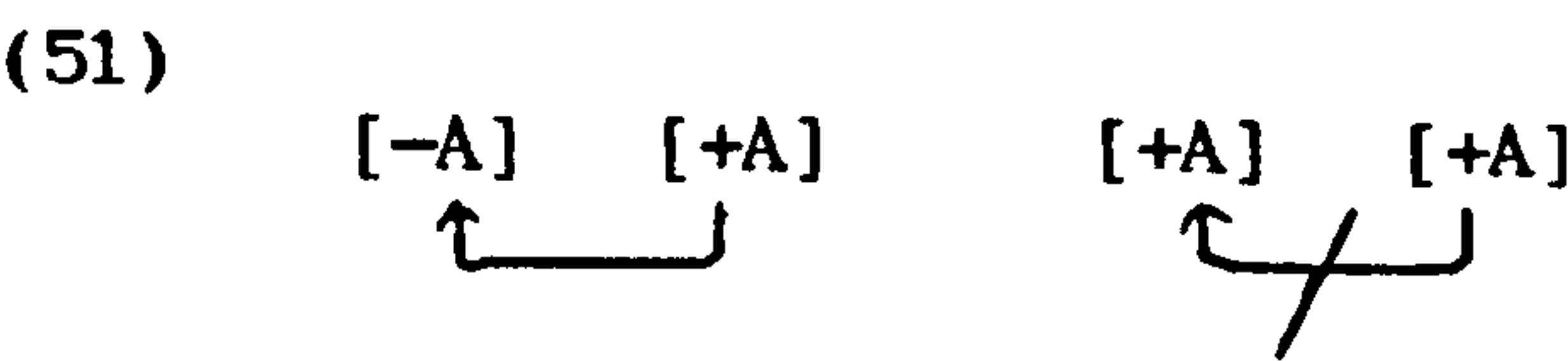
While accent exerts a boosting effect on the preceding word if the word is unaccented, no comparable phenomenon is observed if it is accented. The two phrases in (50a) and (50b) differ from the pair in (50c) and (50d) in the accentedness of the first word. As I showed in Table 19 above, these phrases invariably yielded two minor phrases at the phonetic output with the second components showing an independent initial lowering rather clearly (cf. Figures 4.34 and 4.35). Like the two phrases in (50c)-(50d), this pair of phrases show a marked difference in the height of the second words, reflecting the presence or absence of

accentual boost (cf. Figure 4.37). Unlike (50c)–(50d), however, this pair do not show a significant difference in the height of the first words, as shown in Table 20.

Table 20 Dataset VI (All 20 df)

Parameter	Accent type	Mean(Hz)	SD	t	P
[Valley1]	(50a)	150.8	2.32	1.182	>.20
	(50b)	149.5	2.46		
[Peak1]	(50a)	162.3	2.10	1.069	>.20
	(50b)	160.9	3.81		
[Valley2]	(50a)	130.5	3.59	4.098	<.001
	(50b)	125.5	1.86		
[Peak2]	(50a)	146.5	4.41	5.195	<.001
	(50b)	138.5	2.54		

A comparison of the results in Table 21 and Table 20 suggests that the boosting effect of accent spreads to the preceding word if it is unaccented, but not if it is accented. That is, the accentedness of the preceding word determines the domain within which the effect of accentual boost spreads leftwards. (51) illustrates this.<33>



as a condition on MPF, whereby two words or phrases are combined to form one minor phrase.^{<34>} Under this analysis, words and phrases are intonationally unified with the unaccented element that immediately precedes them whether or not they involve an F0 rise (pseudo-initial lowering) at the phonetic output of speech. Seen conversely, the existence of accent in a given word prompts a minor phrase boundary to fall between the word and the word immediately following it. If this interpretation is correct, it follows that sequences of the accent type in (49c) and (50c) are subject to MPF whereas sequences of the accent type in (49b) and (50b) are not. This argument too speaks for the claim made by Fujisaki and Poser that the accentual prerequisite to the process of MPF consists in the lack of accent in the left-hand word, not in either of the two component words.

6.3. Branching Condition on MPF

As outlined in section 1.4.2 above, there are two competing hypotheses in the literature concerning the influence of syntax on intonational phrasing: Fujisaki & Sudo's (1971) 'branching constraint (BC) hypothesis,' and the 'proper syntactic analysis (PSA) hypothesis proposed by McCawley (1968) and Poser (1984).

6.3.1. Evidence for the BC Hypothesis

6.3.1.1. Dataset VII

The data from my experiments provide at least three lines of evidence for the BC hypothesis. Two of them come from Dataset VII, of which one concerns the surface occurrence of initial lowering and the other concerning the domain of pre-accentual boost, or the leftward spreading of accent-induced F0 boost.

Dataset VII consists of some 120 test phrases of which some forty are right-branching phrases and the rest left-branching phrases. Both of the two types of phrases fall into four groups in terms of the accentual structure (accentedness) of their components, as illustrated in (52) below.

- (52) a) [+A,+A,+A] b) [-A,+A,+A]
 c) [+A,-A,+A] d) [-A,-A,+A]

Of these four groups of phrases, I first compared the two types of branching structures in regard to the phrases of (52d) type.^{<35>} The dataset contains twelve right-branching phrases and thirty-three left-branching phrases of this accent type. In the experimental data, nine of the twelve right-branching phrases clearly showed an F0 rise at the onset of the second word whereas left-branching phrases showed the opposite tendency with only two instances (out of thirty-three) showing a comparable F0 rise (Table 21). This suggests that other things being equal, F0 tends to rise at the beginning of the second element in the

right-branching construction but not in the same position of the left-branching counterpart.

Table 21 Dataset VII: Occurrence of Surface IL

Phrase type	[+IL2]	[-IL2]	Total
Right-Branching	9	3	12
Left-Branching	2	21	23

A second piece of evidence for the BC hypothesis comes from the fact that the process of (pre-)accentual boost is sensitive to the constituent structure of phrases. I showed in section 6.2 above that the leftward spreading of accentual boost is sensitive to the accentedness of the preceding word. In addition to this, the evidence from Dataset VII suggests that the leftward spreading of this F0 boost is sensitive to the constituent relation between the preceding word and the word which involves the trigger (accent) of the process. That is, if the preceding word forms a constituent with the word which contains the trigger, it undergoes the boosting effect (insofar as it is unaccented), whereas it is not subject to such a boosting effect if it does not form a constituent with the accented word itself.

To show this, I first compared the two types of phrases in (52a) and (52c) for the right-branching and left-branching phrases respectively. Figure 38 compares the two types of phrases for the right-branching construction on the basis of the

mean F0 values of major parameters. Table 22 summarizes the data and statistical results of the comparison.

Table 22 Right-Branching Construction: (52a) vs (52c)
(All 17 df)

Parameter	Accent type	Mean (Hz)	SD	t	P
[Valley1]	(52a)	165.0	6.89	0.464	>.20
	(52c)	166.4	5.64		
[Peak1]	(52a)	181.5	6.65	1.358	>.20
	(52c)	186.2	8.01		
[Valley2]	(52a)	144.4	5.78	3.386	<.01
	(52b)	135.8	5.02		
[Peak2]	(52a)	168.3	7.07	3.433	<.01
	(52b)	158.0	5.53		

These two types of phrases show a remarkable difference in the height of the second element because of the effect of accentual boost. As expected, however, the boosting effect of the accent of the second word is not observed in the first word, since the latter is accented. The left-branching construction shows the same result, as summarized in Figure 39 and Table 23, where no significant difference is observed about the height of the first word.

Table 23 Left-Branching Construction: (52a) vs (52c)
(All 37 df)

Parameter	Accent type	Mean (Hz)	SD	t	P
[Valley1]	(52a)	166.7	6.34	1.186	>.20
	(52b)	169.0	5.54		
[Peak1]	(52a)	187.6	3.33	0.610	>.20
	(52b)	188.4	4.79		
[Valley2]	(52a)	147.8	8.93	5.022	<.001
	(52b)	136.2	4.39		
[Peak2]	(52a)	162.7	4.84	6.723	<.001
	(52b)	150.8	6.20		

While the two types of branching structures thus show no difference in the effect of accentual boost if their first word is accented, they show different behavior if the first word is unaccented. Figure 40 and Table 24 compare the F0 values of the two sets of right-branching phrases in (52b) and (52d). Figure 41 and Table 25 summarize the data for the left-branching phrases.

Table 24 Right-Branching Construction: (52b) vs (52d)
(All 20 df)

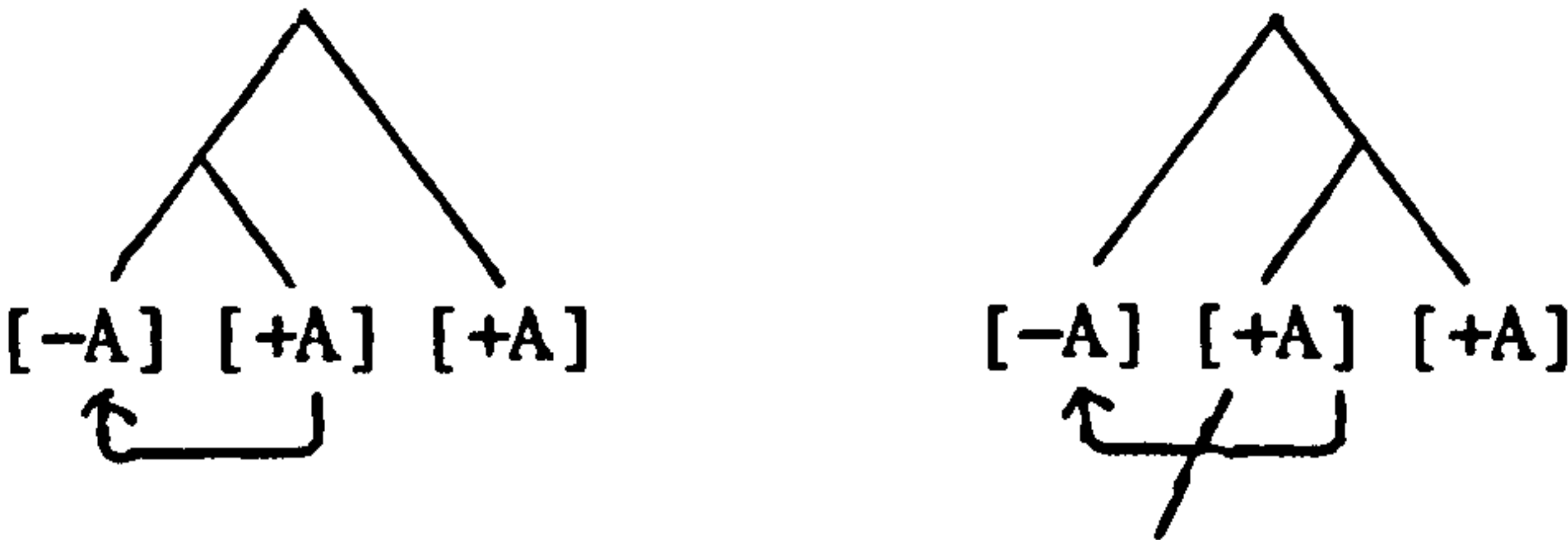
Parameter	Accent type	Mean (Hz)	SD	t	P
[Valley1]	(52b)	158.4	4.75	0.000	>.20
	(52d)	158.4	5.04		
[Peak1]	(52b)	176.2	4.37	0.726	>.20
	(52d)	174.9	5.32		
[Valley2]	(52b)	172.9	7.31	3.083	<.01
	(52d)	164.3	5.41		
[Peak2]	(52b)	178.9	5.19	5.142	<.001
	(52d)	168.0	4.63		

Table 25 Left-Branching Construction: (52b) vs (52d)
(All 44 df)

Parameter	Accent type	Mean (Hz)	SD	t	P
[Valley1]	(52b)	161.2	4.10	1.641	>.10
	(52d)	159.0	4.87		
[Peak1]	(52b)	177.2	3.64	3.288	<.01
	(52d)	173.2	4.66		
[Valley2]	(52b)	174.5	4.68	4.641	<.001
	(52d)	167.4	5.66		
[Peak2]	(52b)	178.4	3.87	7.794	<.001
	(52d)	167.8	5.28		

In sum, the boosting effect of the accent in the second word spreads to the preceding unaccented word in the left-branching structure but not in the right-branching structure, despite the fact that they both satisfy the condition on accentedness. This suggests that the effect of accentual boost does not spread to the preceding word if the two words involved do not form a constituent by themselves. In other words, the boosting effect of accent does not spread across a right-branching syntactic node, as illustrated in (53). This difference is best characterized as a difference in intonational phrasing: the right-branching structure is bound to introduce a minor phrase boundary at the syntactic constituent boundary marking the right-branching structure.

(53) Branching Constraint on Accentual Boost



6.3.1.2. Dataset IV

The data from Dataset IV provide a third and probably the most crucial evidence for Fujisaki & Sudo's hypothesis that MPF is blocked in the right-branching structure. This dataset includes the four phrases shown in (54), which differ from each other in constituent structure. These phrases all consist of four unaccented words (or simplex phrases) and should, hence, be in no way subject to the accentual condition on the intonational process.

(54) (= (46)) Dataset IV

- a) [[naomino aneno][marui yunomi]
"Naomi-Gen" "sister-Gen" "round" "teacup"
= "Naomi's sister's round teacup"
- b) [[naomino [ueno aneno]] yunomi]
"Naomi-Gen" "upper-Gen" "sister-Gen" "teacup"
= "Naomi's eldest sister's teacup"
- c) [naomino [[umeno irono] yunomi]]
"Naomi-Gen" "plum-Gen" "color-Gen" "teacup"
= "Naomi's plum-colored teacup"
- d) [naomino [omoi [marui yunomi]]]
"Naomi-Gen" "heavy" "round" "teacup"
= "Naomi's heavy round teacup"

If there were no syntactic influence on the process of intonational phrasing, the four phrases should yield an identical intonational pattern or, at least, they should show no systematic difference in intonational phrasing. The fact is, however, that a sharp rise in pitch occurs at the beginning of

every word which does not form a constituent with its immediately preceding element (cf. Figures 4.25-4.28). (55) schematically illustrates this.

(55) (= (47))

a) na√omino aneno ma√rui yunomi

b) na√omino u√eno aneno yunomi

c) na√omino u√meno irono yunomi

d) na√omino o√moi ma√rui yunomi

These phrasing patterns are obviously governed by one and the same principle. That is, MPF is blocked wherever a right-branching structure is involved, but not where a left-branching structure is involved. In other words, the right-branching structure shows a marked behavior by blocking the intonational phrasing process, whereas the left-branching counterpart show no such behavior. The asymmetry which the two types of branching structures show with respect to intonational phrasing is particularly in evidence in (55b) and (55c). In (55b), the first three elements constitute a right-branching structure and, therefore, result in two intonational (minor) phrases with a phrase boundary between the first and second elements. The last three elements in (55c), by contrast, constitute a left-branching structure and are fused into one minor phrase.

6.3.1.3. Summary

To summarize the discussion so far, I have given three lines of evidence to support the hypothesis that the right-branching structure is marked in intonational phrasing in Japanese. First, the right-branching structure tends to show a phrase-initial F0 rise characterizable as initial lowering at the beginning of the second element whereas the left-branching structure shows no comparable tendency. Second, the effect of accentual boost does not spread over a right-branching syntactic node. And third, sequences of unaccented elements exhibit initial lowering wherever the right-branching structure is involved. From these three lines of evidence, it can be concluded that the right-branching structure is marked in intonational phrasing in Japanese. Other things being equal, MPF is blocked between the sequences of elements where the right-hand element branches (cf. (56a)), but not where the left-hand element branches (cf. (56b)).

- (56) a) [A [B C]] → A/BC
b) [[A B] C] → ABC

It may be worth recalling in this regard that exactly the same branching constraint as this applies to the accentual phrasing process observed in compound formation (cf. Chapter Two, section 3.3). Since accentual phrasing and intonational phrasing represent two independent processes, it can be understood that the branching constraint as shown in (56) is a rather general constraint in Japanese phonology. It implies, in

other words, that the right-branching structure represents a marked structure in the phonological system of the language in general.

6.3.2. Evidence Against the PSA Hypothesis

I claimed in the preceding section that intonational phrasing in Japanese shows an asymmetry whereby the right-branching structure shows its markedness by blocking the phrasing process. Since the PSA hypothesis inherently assumes no such asymmetry or discrimination in markedness, all the evidence presented so far constitutes potential evidence against the PSA hypothesis per se. However, this does not imply that the PSA hypothesis is totally incompatible with the finding that the right-branching structure shows marked behavior. Since the essence of this hypothesis lies in the concept of the cyclic application of intonational phrasing, it is theoretically possible to incorporate the branching constraint discussed above into the phonological system in which MPF applies in the manner defined by the PSA hypothesis.

6.3.2.1. Dataset IV

My experimental data provide, however, one piece of evidence against the PSA hypothesis. As shown in (55b), the phrase in (54b) yields an intonational pattern whereby the last three elements form a minor phrase to the exclusion of the first. What is striking in this intonational patterning is that MPF has

c) [[na'okono aneno] namae]

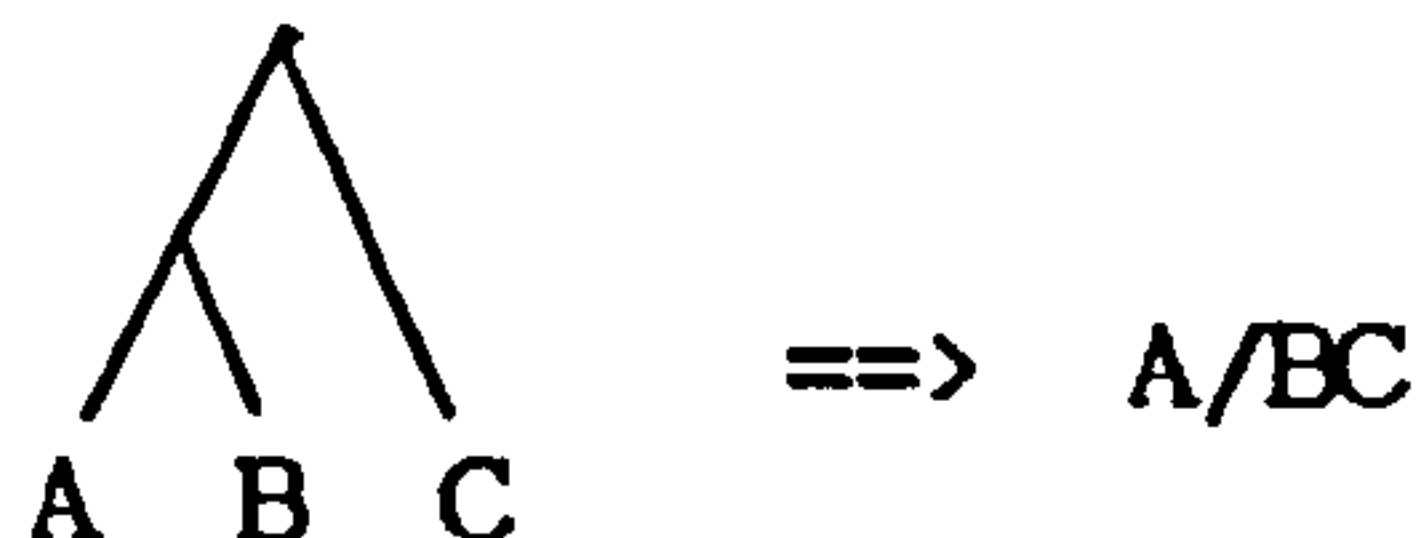
"Naoko-Gen" "sister-Gen" "name"
= "Naoko's sister's name"

d) [[ke'nediio korosita] otoko']

"Kennedy-Acc" "killed" "man"
= "the man who killed Kennedy"

The first two elements of these phrases do not generally form a unified minor phrase because MPF is blocked between them due to the accentual condition. According to my impressionistic observation, however, the second and third elements of these phrases usually undergo the phrasing process to yield one unified minor phrase. That is, even though MPF is blocked between the first two elements, it readily applies to the sequence of the second and third elements, that is, to the sequence which does not form a constituent syntactically. The syntax-phonology discrepancy can be illustrated as in (59).^{<36>}

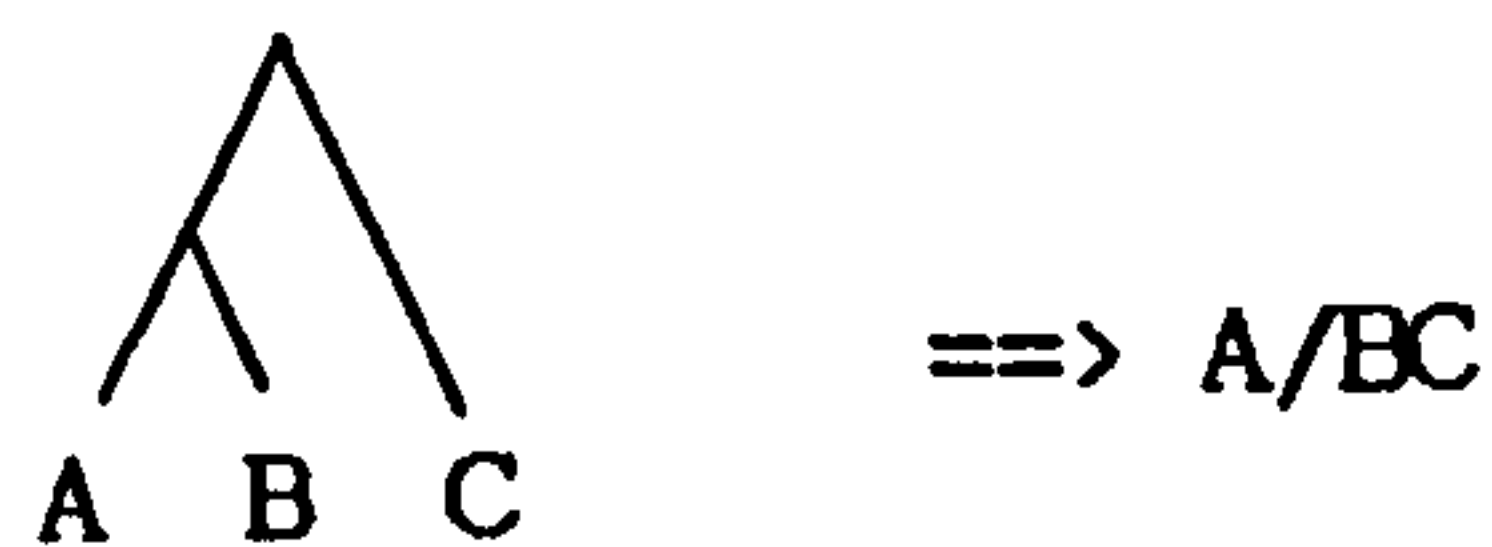
(59)



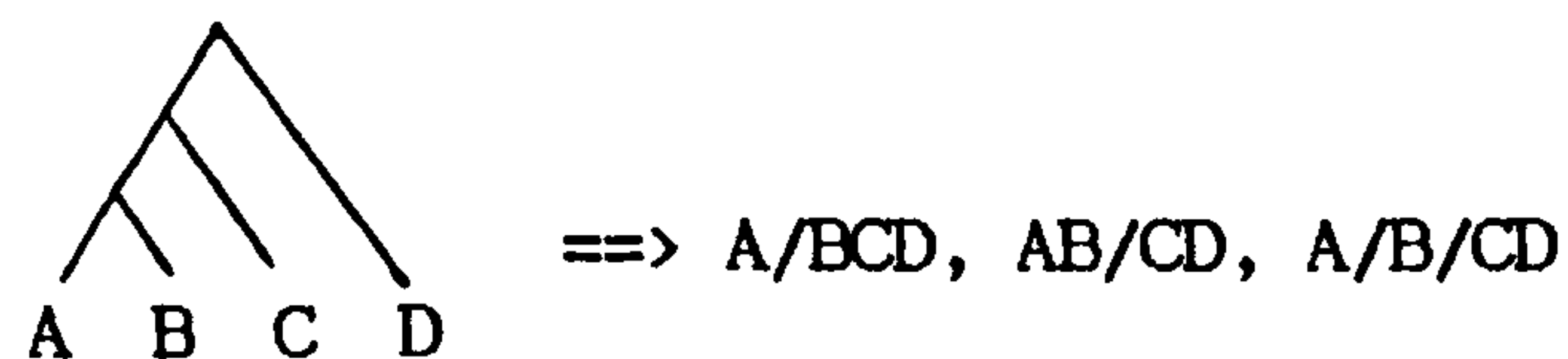
Comparable discrepancies between the syntactic and phonological structure are observed in the accentual phrasing in compound formation. (60) summarizes the discrepancies I discussed in Chapter Two.

(60) Syntax-Phonology Discrepancies in Accentual Phrasing

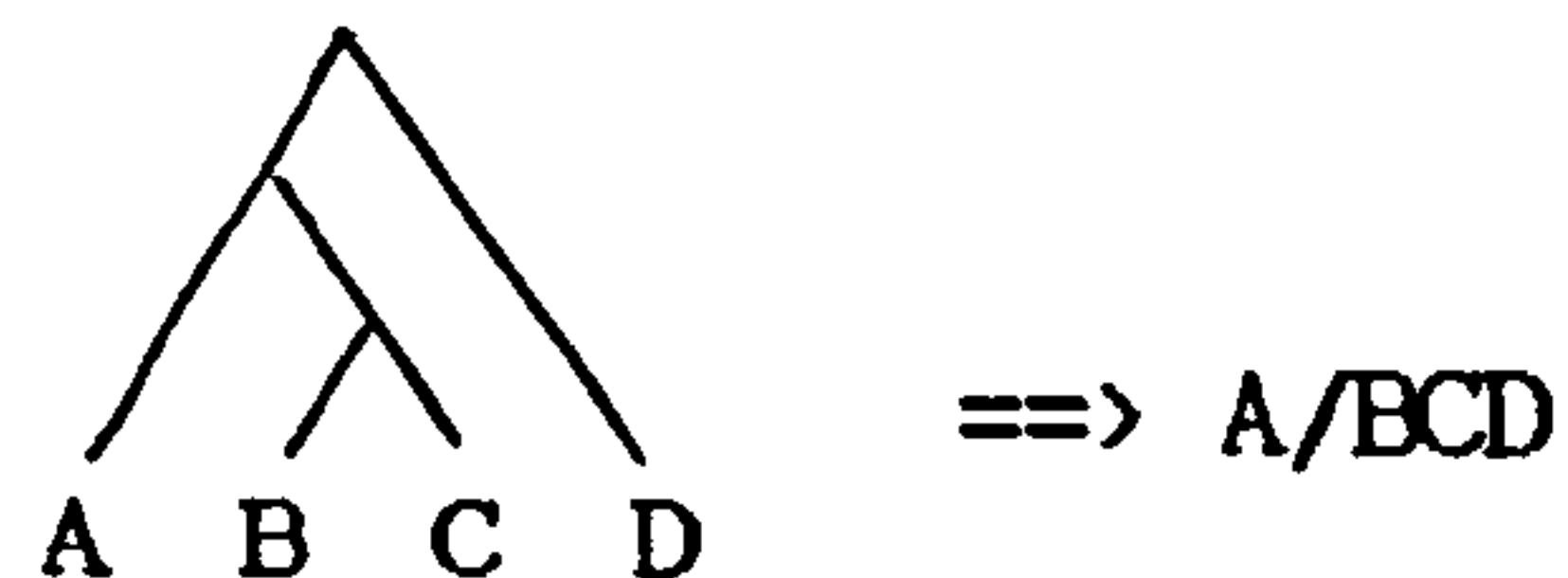
a)



b)



c)



The syntax-phonology discrepancies illustrated in (57), (59) and (60) are obviously governed by a single principle, which states that phrasing process, whether it is accentual phrasing or intonational phrasing, can unify two adjacent elements into a single prosodic phrase even if they do not form a constituent syntactically.

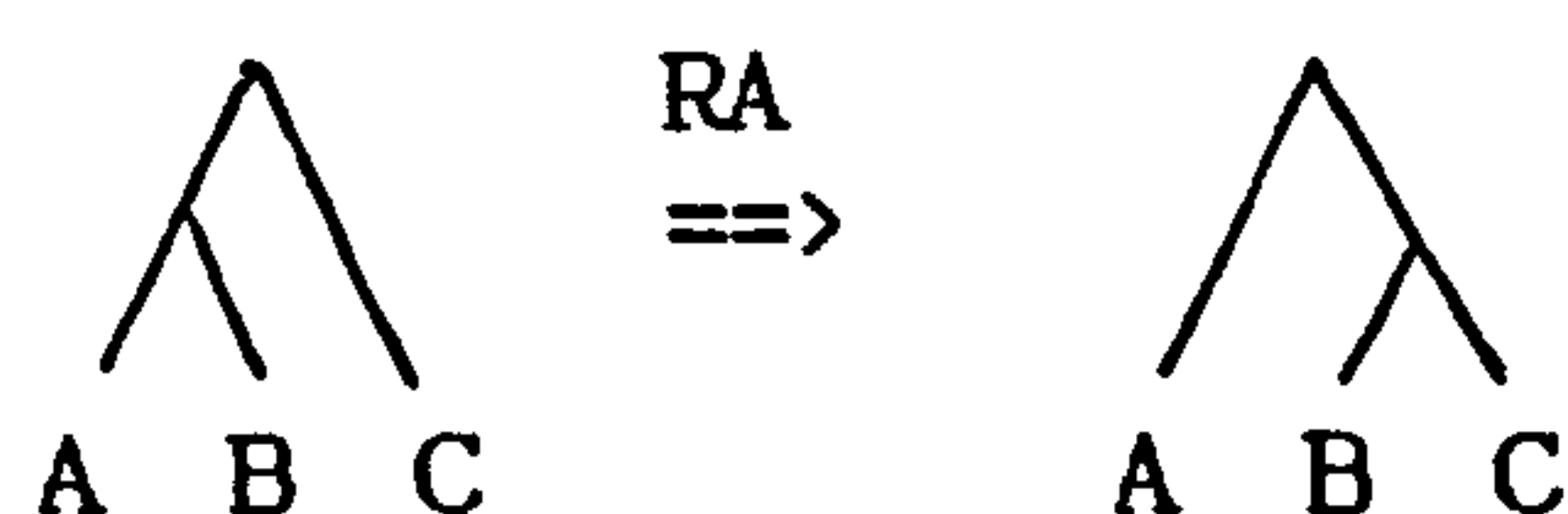
6.3.2.2. Evidence Against Reanalysis

Given this principle regarding the syntax-phonology discrepancies, it is obvious that it is not compatible with the PSA hypothesis, which states that MPF yields only those phrasing patterns that square with the constituent structure defined on the syntactic tree. The only way to account for it under the

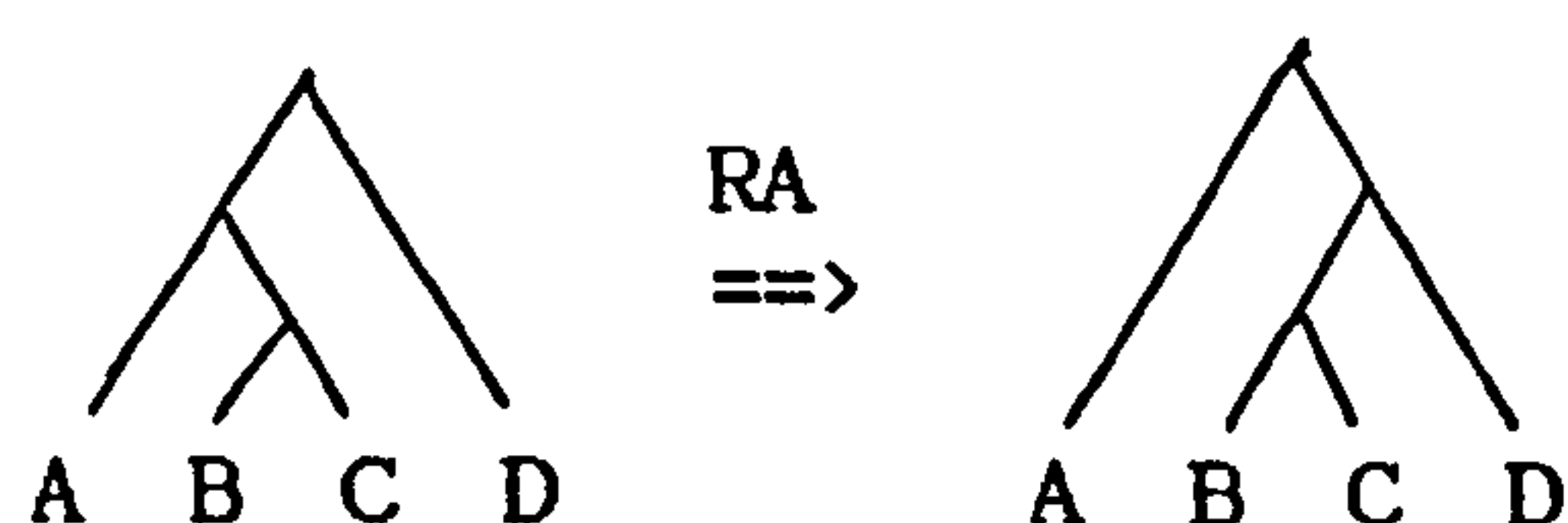
PSA hypothesis is, in fact, to postulate a reanalysis of the syntactic tree, as illustrated in (61) below.^{<37>}

(61) Reanalysis (RA)

a) (cf. (59))



b) (cf. (57))



Under this analysis, all the discrepancies between the syntactic and phonological structure are attributed to the reanalysis of the syntactic tree which takes place in prior to MPF. Thus, the biphrasal intonational pattern in (57) and (59) is now seen to result due to the branching condition applying to the reanalyzed structures shown in (61). (62) illustrates the whole process of phonological derivation.

(62)

	(59)	(57)
Input	[[A B] C]	[[A [B C]] D]
RA	[A [B C]]	[A [[B C] D]]
MPF	A/BC	A/BCD

While the syntax-phonology discrepancies in question seem to

be reasonably accounted for by way of the additional machinery of reanalysis, there is experimental evidence which speaks against this line of analysis. As illustrated in (62), the account based on reanalysis assumes that the left-branching phrases as in (58) are restructured into the right-branching phrases as in (61a) in prior to the intonational phrasing. Since these two types of phrases are completely neutralized at this stage, they are supposed to be given one and the same intonational representation and, hence, to show one and the same pattern in intonational realization. This prediction can be shown to be untenable by the experimental data.

As will be discussed in the next chapter in detail (sections 3-4), two types of branching structures, right-branching and left-branching, show a systematic difference in regard to downstep, one of the intonational processes which apply at a later stage than MPF. Dataset VIII includes several pairs of phrases as given in (63), for example. These pairs of test phrases do not show identical downstep patterns but exhibit a significant difference in the height of the second elements. To be more specific, the right-branching phrases show a higher pitch in the second element than the left-branching counterparts (cf. Figure 4.42).

(63) Dataset VIII

a) [o'okina [omoi me'ron]]

"a big heavy melon"

b) [[o'okina mimino] o'okami]

"big" "ear-Gen" "wolf"

= "a wolf with big ears"

This kind of intonational differences, which reflect the difference in syntactic structure, are observed not just with a handful of examples but are found widely in the downstep phenomenon of Japanese. In fact, the distinction between the two types of branching structures is essential to proper understanding of the intonational phenomenon.

The fact that the process of downstep requires information on constituent structure of the sentence indicates that the two types of branching structures are not neutralized at (or before) the stage of intonational phrasing. In other words, the information on syntactic hierarchy is somehow retained in the intonational representation to which downstep applies. Seen in this light, it is clear that the account based on the notion of reanalysis makes a wrong generalization and cannot, therefore, be empirically supported.

6.3.2.3. Summary and Theoretical Implications

The foregoing discussion has shown that the notion of 'reanalysis' does not work to account for the syntax-phonology discrepancies observed in intonational phrasing. Given this, it

follows that the notion of cyclic application of phonological rules (MPF in our present discussion) does not work in Japanese. This consequence has a significant implication for the theory of Japanese phonology in general in the sense that there is a counterexample against the principle of cyclicity, which has been one of the most basic tacit assumptions in the theory of Japanese phonology since the advent of generative phonology.

If the principle of cyclicity does not work, the only way we can account for the syntax-phonology discrepancies is to postulate the 'linear application,' or a structure-independent application of phonological rules and processes, which I suggested in Chapter Two (section 3). Under this analysis, MPF takes place independently of the syntactic structure of the sentence, by applying either in a left-to-right fashion or in a right-to-left fashion. (64) illustrates these: /*/ denotes that the rule is blocked at the relevant stage of rule application due to the accentual or branching condition.

(64) 'Linear' application of MPF

a) Left-to-Right Application

	(59)	(57)
Input	[[A B] C]	[[A [B C]] D]
<step1>	*A B	*A B
<step2>	B C	B C
<step3>	—	C D
Output	A/BC	A/BCD

b) Right-to-Left Application

	(59)	(57)
Input	[[A B] C]	[[A [B C]] D]
<step1>	B C	C D
<step2>	*A B	B C
<step3>	——	*A B
Output	A/BC	A/BCD

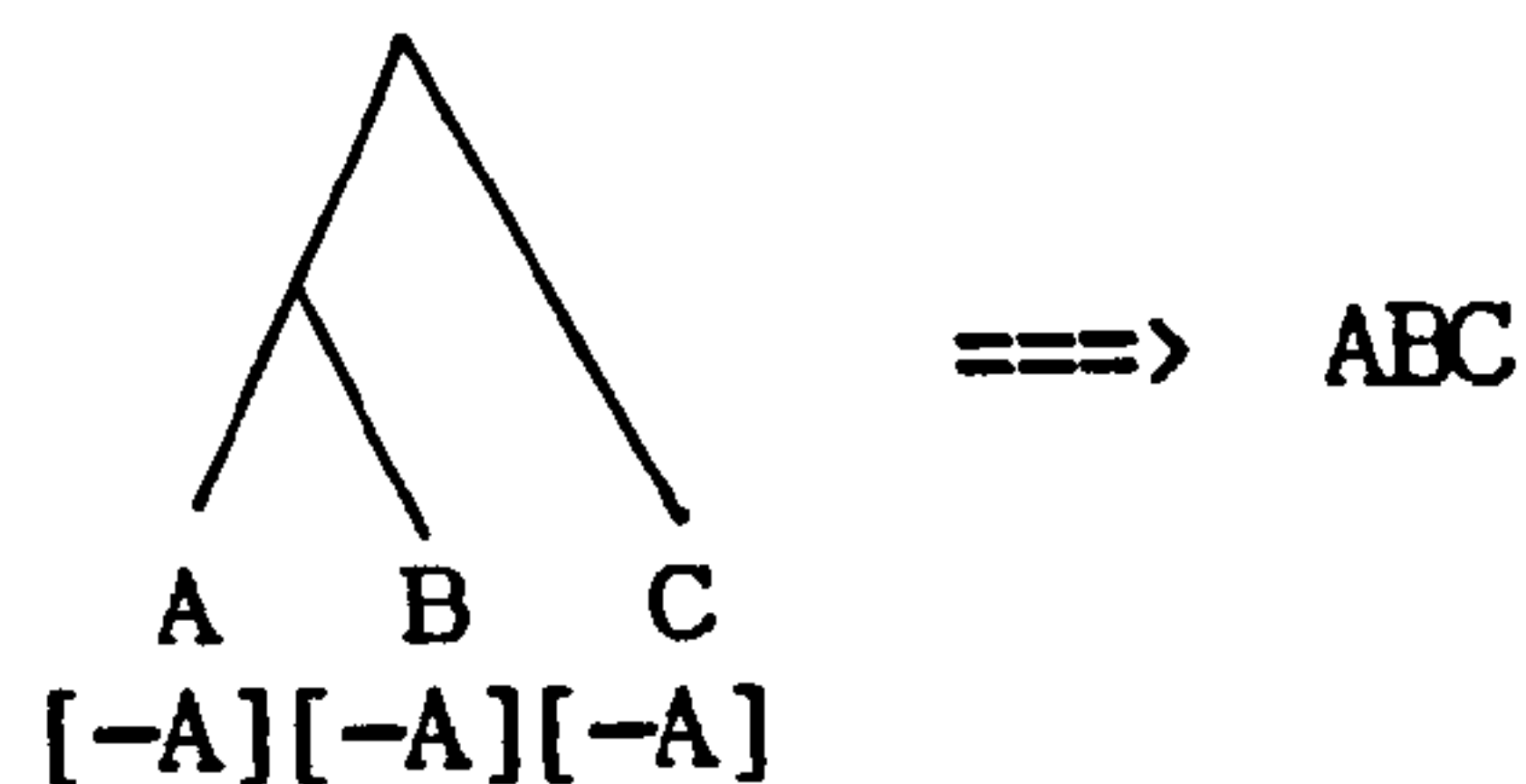
6.4. Rhythmic Condition on MPF

Before concluding our discussion on linguistic factors influencing the choice of intonational phrasing, let us consider one more condition on the phrasing process. As cited above, Poser remarks that the choice of intonational phrasing is influenced by the "size and number of the minor phrases within a parent constituent" (p.155). According to a careful examination of my experimental data as well as my intuition as a native speaker of Japanese, it is not the size of minor phrases but their number within a stretch of speech that is relevant in Japanese.

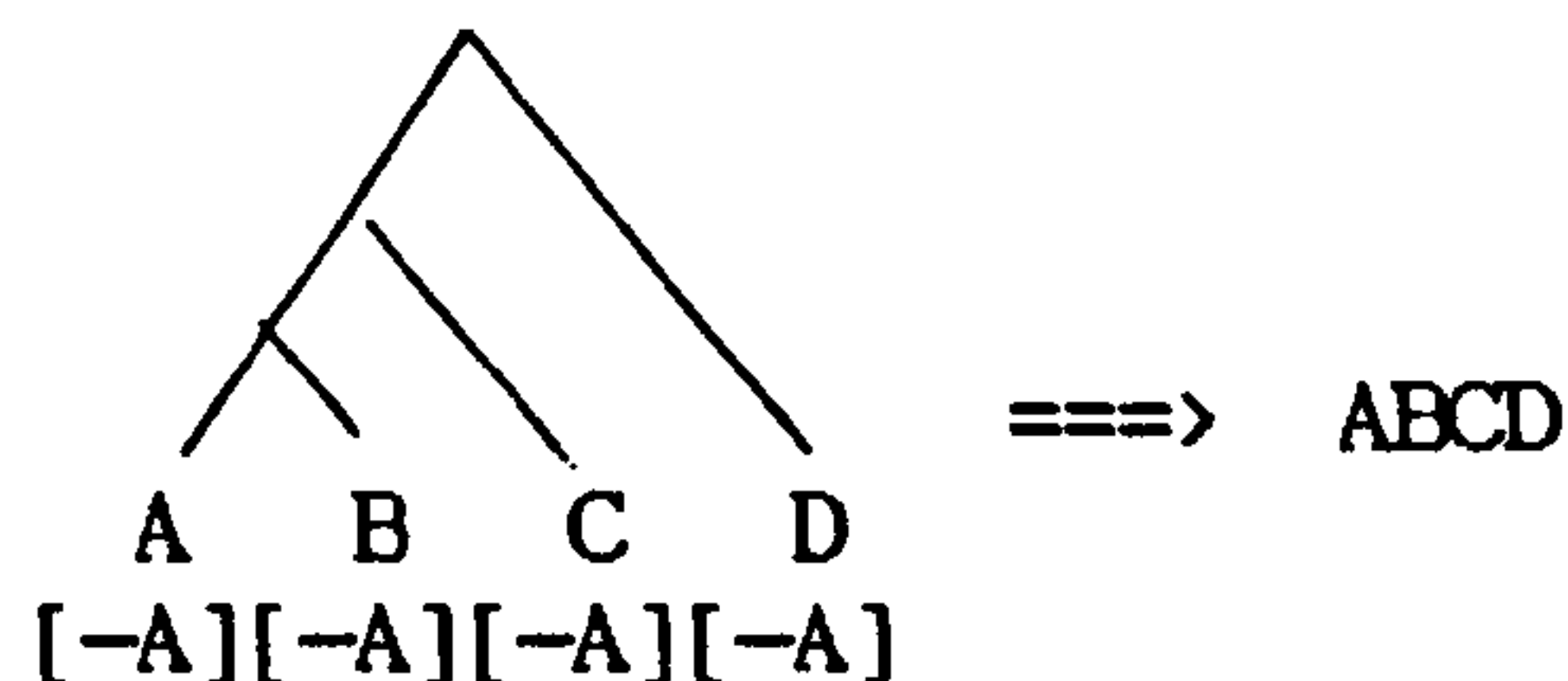
The discussion in the preceding sections shows that the process of MPF is subject to two linguistic conditions, accentual and branching. Given these conditions, uniformly left-branching constructions made up of unaccented words should represent an entirely unmarked case, and it is predicted that they undergo MPF entirely to yield one minor phrase irrespective of the number of elements involved, as shown in (65).

(65) MPF

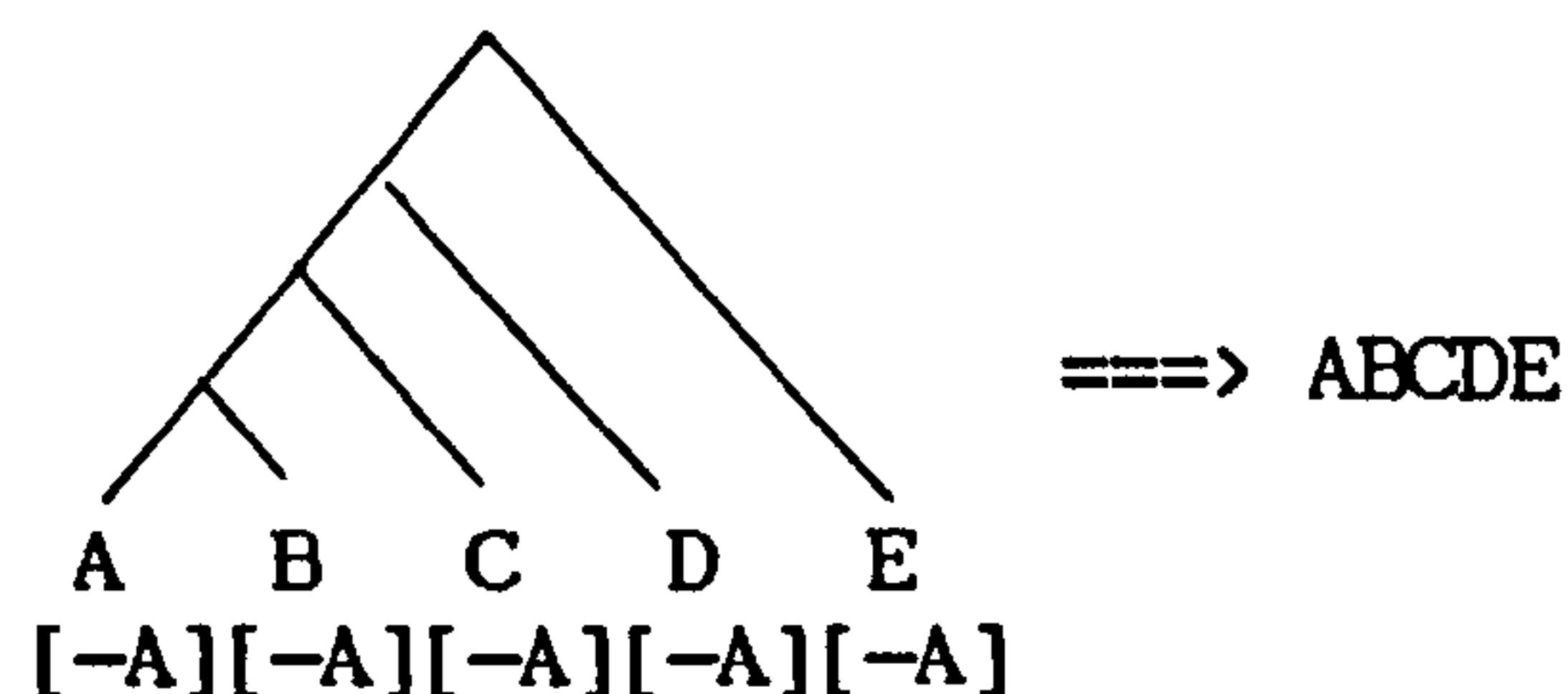
a)



b)



c)



What actually happens, however, is that the intonational patterning in (65b) and (65c) rarely results while the patterning in (65a) is rather common. According to my observation, the concatenation of three unaccented words or phrases readily leads to one minor phrase, but that of four or more unaccented elements show a strong resistance to being phrased into a single intonational unit. This observation is supported by the evidence from Dataset IV.

Dataset IV includes the phrase shown in (66), which consists

of four unaccented words or simplex phrases. This phrase was never phrased into one minor phrase in my data, but was realized in two or three minor phrases as shown in (67). Table 26 gives the summary of the frequencies with which these patterns actually occurred.

(66) Dataset IV

[[[naomino oino] yomeno] yunomi]
 "Naomi-Gen" "nephew-Gen" "wife-Gen" "teacup"
 = "Naomi's nephew's wife's teacup"

(67) Intonational Realization

- a) AB/CD naamino oino yomeno yunomi
- b) A/BCD naomino oino yomeno yunomi
- c) A/B/CD naomino oino yomeno yunomi

Table 26 Dataset IV: Summary

Pattern	(67a)	(67b)	(67c)
Frequency	6	3	2

Apart from the tendency whereby long phrases break into more than one minor phrase, the result in Table 26 reveals two interesting facts to note. Note, first, that the three patterns that are actually manifested represent the patterns which are shown by phrases of other branching structures (cf. (55) above). In other words, of the logically possible phrasing patterns, the

left-branching phrase chose only those patterns that are syntactically permitted (cf. (68a)) in preference to those which are not syntactically permissible (cf. (68b)). This suggests that syntax severely constrains the phrasing patterns which uniformly left-branching structures can possibly take, or the manner in which the structures in question can be intonationally split.

(68) a) Syntactically Permissible Phrasing Patterns

ABCD, AB/CD (= (55a)), A/BCD (= (55b,c)),
A/B/CD (= (55d))

b) Syntactically Impermissible Phrasing Patterns

ABC/D, AB/C/D, A/BC/D, A/B/CD

The other important point to note about the choice of phrasing in Table 26 is the fact that the uniformly left-branching phrase in (66) takes the pattern in (67a) as the most preferred pattern and that the phrase is thereby intonationally neutralized with the symmetrically branching phrase given in (54a) above. It should be recalled in this regard that this phrasing pattern is also preferred in the process of accentual phrasing, where uniformly left-branching compound nouns made up of four elements optionally split into two accentual phrases with an accentual phrase boundary placed between the second and third elements. As a result of this optional splitting, the uniformly left-branching compounds come to be accentually neutralized with symmetrically branching compounds, as shown in (69) below (cf. Chapter Two, Section 3.4).

(69) Accentual Phrasing

a) [[[toonan a'zia] syo'koku] rengoo]

→ toonana'zia syokokure'ngoo

"east-south" "Asia" "nations" "union"
= "Association of South-East Asian Nations (ASEAN)"

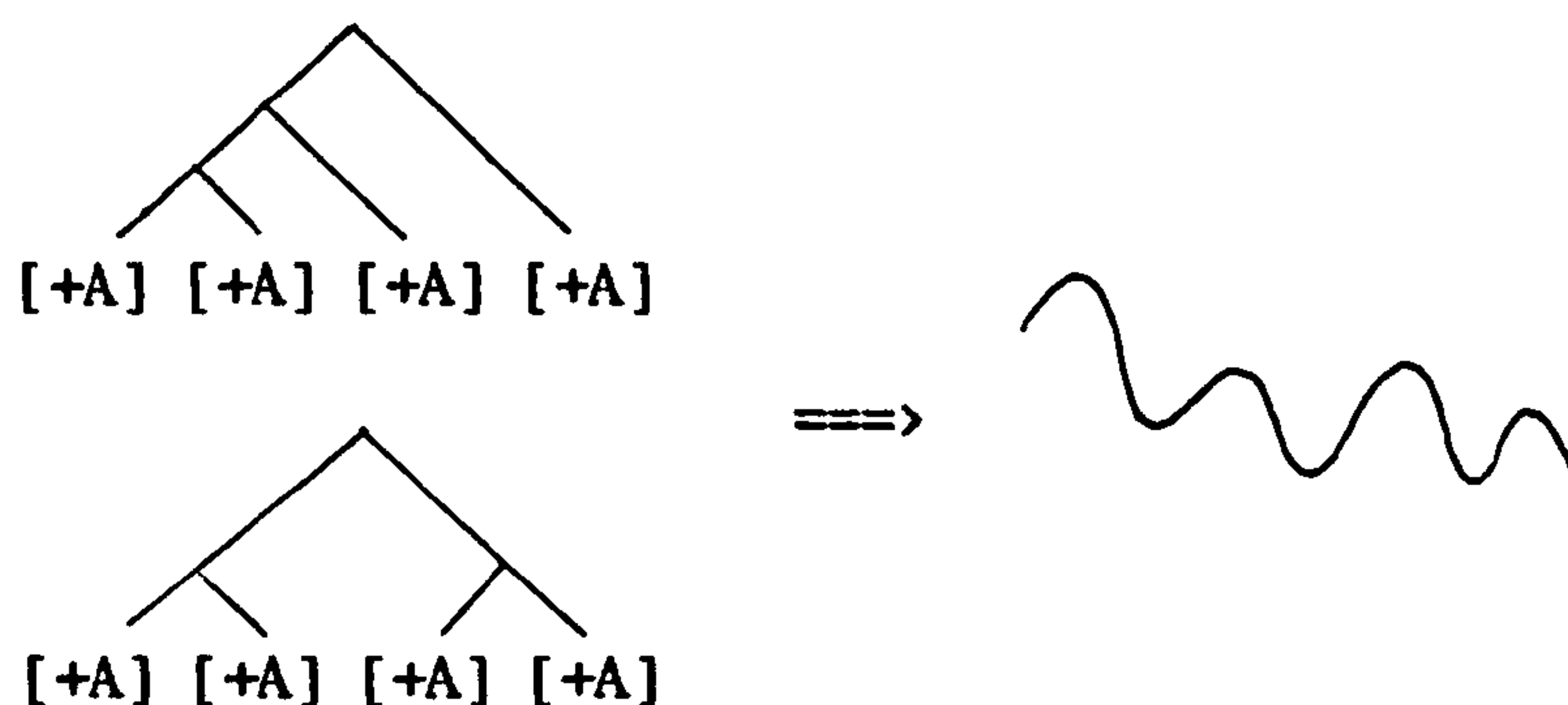
b) [[ke'izai taisaku][kakuryoo ka'igi]]

→ keizaita'isaku kakuryooka'igi

"economy" "measures" "cabinet member" "meeting"
= "a cabinet meeting on economic measures"

Moreover, the grouping of four elements into two subgroups of two is also observed in the process of downstep where, again, uniformly left-branching phrases are neutralized with symmetrically branching phrases (cf. Chapter Five, section 5).

(70) Downstep



On the basis of all these facts, I claimed in Chapter Two that the three prosodic process mentioned above — accentual phrasing, intonational phrasing and downstep — are all conditioned by one and the same factor, or the principle of rhythmic alternation. Under this account, the intonational

phrasing in (67a) is not an isolated phenomenon but is part of the larger phenomenon of rhythmic alternation whereby monotonous sequences of linguistic elements are converted into two subgroups so that the resultant patterns involve an alternation of some kind or other.^{<38>} If this is the case, then uniformly left-branching phrases as in (66) are seen to be reanalyzed by this abstract condition on prosodic rules into the symmetrically branching construction. This is illustrated in (71) below.

(71)

Input	[[[A B] C] D]
Reanalysis	[[A B][C D]]
MPF	AB/CD

In sum, it can be concluded that the process of intonational phrasing is constrained not simply by the two factors outlined in the preceding sections — accentual and branching conditions — but also by the rhythmic factor, and that this third factor, like the branching condition, constrains the prosodic processes of Japanese as a rather general principle.

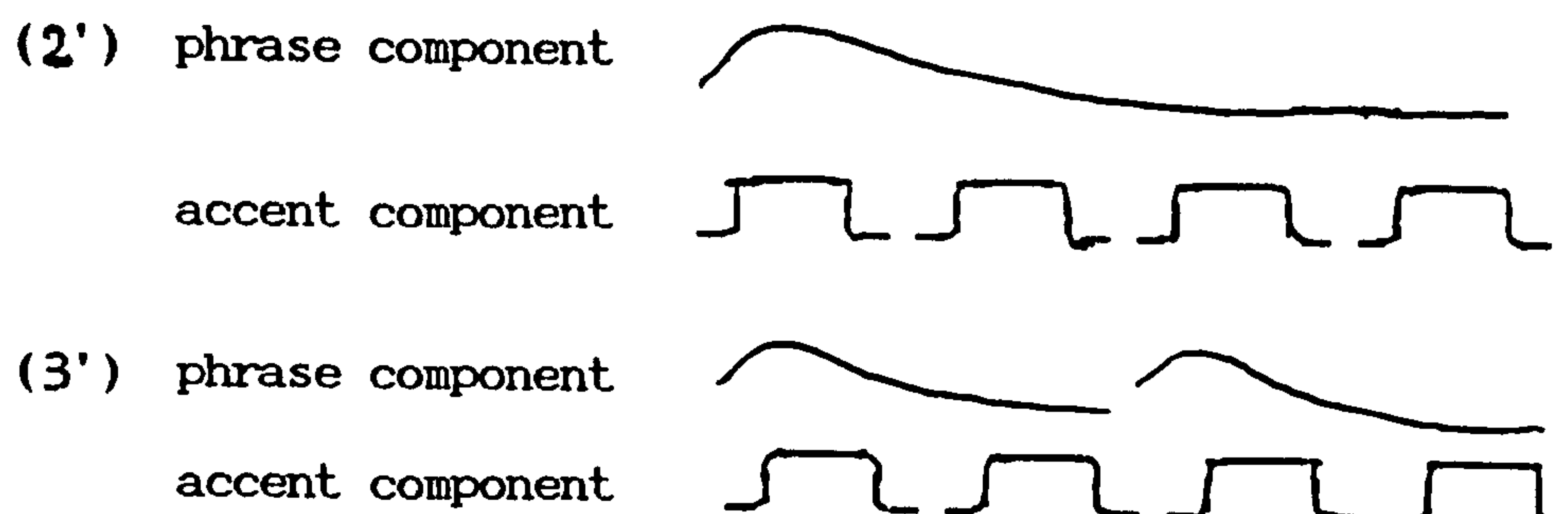
NOTES TO CHAPTER FOUR

1. Beckman & Pierrehumbert (1986) exceptionally assume a third intonational phrase which they call 'the intermediate phrase.' According to them, this phrase "can be as short as a single accentual phrase (our 'minor phrase':HK)" and "seldom contains more than three" minor phrases. They define it as "the domain of catathesis (downstep)," or the phonologically conditioned lowering of pitch. Their main motivation for this intonational phrase lies in their belief that there are two types of "modifier-noun sequences", one in which downstep takes place and the other in which it does not.

In my experiments, I analyzed many phrases involving the same type of sequences, but no such discrimination could be made. That is, all the "modifier-noun sequences" I analyzed showed the effect of downstep if certain conditions are met, providing no evidence for the intermediate intonational phrase assumed by Beckman and Pierrehumbert. I must therefore say that the status of this third intonational phrase is still to be verified in the future.

2. In explaining their technique of analysis, Fujisaki, Hirose & Ohta (1979:167) state that "the number of voicing commands (our 'major phrases':HK) and that of the accent commands (our 'minor phrases': HK) for the sample are determined by the preliminary observation of the extracted F0 contour."

3. The 'major phrase' and 'minor phrase' as I use in this thesis correspond to the 'voicing unit' and 'accent unit' in Fujisaki's intonational model (cf. Fujisaki & Sudo, 1971). As will be outlined in section 1 of Chapter Five, these units form the basic descriptive units of the 'phrase component' and 'accent component' respectively. These two components yield independent F0 contours which give rise to the surface F0 contour when superimposed on each other. Under this analysis, the difference between the F0 contours in (2) and (3) can be seen as a difference in the phrase component as shown in (2') and (3') below.



4. None of the earlier studies on Japanese intonation assumes an intonational phrase larger than the major phrase. That is,

earlier studies posit no intonational phrase governing the two major phrases in (5).

5. As will be mentioned shortly, McCawley-Poser's "major phrase" and Fujisaki's "voicing unit" are both defined as the domain of the intonational phenomenon whereby pitch tends to drop during the course of utterances.

6. McCawley (1968) and Shibatani (1972) take the same approach. McCawley states that "at present I am unable to say much about how major phrase boundary is introduced syntactically," suggesting that the placement of major phrase boundaries are determined by some syntactic criterion. Shibatani goes a step further than McCawley by saying that a major phrase refers to a "noun phrase or verb phrase with more than one noun or verb" (p. 587).

7. Similarly, Fujisaki & Ohta (1979:167-8) state that "each voicing unit does not necessarily correspond to a breath group, but instead, closely relates with the syntactic structure of the sentence."

8. Poser states that the topic phrase "seems to have no effect on the following material" but he has shown no evidence to support this claim. According to my intuition and impressionistic observation, the topic phrase does affect the intonational realization of the following phrases. In the sentences given below, for instance, I have an impression that the word i'ranni is realized at a lower F0 level in (a), that is, when following an accented topic phrase, than in (b), in which it follows an unaccented topic phrase. This is exactly what Poser calls 'catathesis' (downstep) which, according to Poser, takes place in the domain of the major phrase. Paradoxical situations of this sort will be discussed partly in section 2 below and in Chapter Five (section 4) in full depth.

a) na'okowa i'ranni itta
"Naoko-Top" "Iran-to" "went" = "Naoko went to Iran"

b) naomiwa i'ranni itta
"Naomi-Top" "Iran-to" "went" = "Naomi went to Iran"

9. Shibatani (1971) adopts the same line of definition of the major phrase. See Chapter Five (sections 1 and 2) for a detailed discussion of Shibatani's account as well as McCawley's accent reduction model.

10. See Chapter Five (section 1) for a sketch of Poser's downstep model.

11. The reason that I disfavor the term 'accent(ual) phrase' is that we need this term to describe a prosodic unit in accent phrase formation process involved in compound formation. As long as this prosodic process differs from the process of intonational phrasing to be outlined in section 1.4 below, there seems to be

good reason to differentiate the two prosodic units, 'accentual unit' and 'minor intonational unit' (cf. Chapter Two). The term 'minor phrase' used in this thesis should, accordingly, be taken as denoting the same intonational phrase as what Beckman & Pierrehumbert call 'accentual phrase'.

12. Poser states that the minor phrase is "the smallest unit at which the shape of the F0 contour is determined," or the unit which "receives a tonal melody" (p.141).

13. Poser (p. 141) makes this point very clearly by saying that "it is the minor phrase that is the domain of initial lowering and it is the minor phrase that has the property of containing at most one (realized) accent."

It must be noted, however, that opinions differ in the phonetic interpretation of initially-accented words and phrases. Fujisaki, Poser and Beckman & Pierrehumbert assume that initially-accented words and phrases involve an initial lowering (i.e. phrase-initial F0 rise) just like words and phrases accented on other syllables. McCawley and Haraguchi (and many other traditional phonologists), on the other hand, hold that initially-accented words do not involve initial lowering at least at the phonological (tonal) level. Since a major task of this thesis is to refine Poser's data and analysis, I will tentatively follow the first line.

14. Poser states (p. 315) that "there is no reason to believe that under any circumstances total catathesis occurs in Japanese."

15. These morpho-syntactically defined sequences of morphemes correspond to what Hashimoto (1934) describes as 'bunsetsu,' which is generally adopted as a relevant descriptive unit in Japanese syntax.

16. McCawley and Poser shows a slight disagreement as to which what sequences of morphemes constitute 'minimal minor phrase.' McCawley treats auxiliary verbs as a lexical item which can form a (minimal) minor phrase on their own whereas Poser seems to treat them as a kind of particles.

17. As I suggested in Chapter Two (section 2), the intonational pattern in (9a) also seems to be preferred when pragmatic focus is placed on (part of) the phrase.

18. Fujisaki states that "there also exists a systematic rule for the concatenation of these units (i.e. accent units: HK) into a phrase which in turn behaves as a single accent unit called 'accent phrase'" (Fujisaki & Sudo, 1971:76). Similarly, Poser (p. 152) states that "minimal minor phrases may be combined to form larger minor phrases."

19. Poser remarks that the pattern in (14a) does occur in Japanese under a certain condition. He attempts to account for this by positing a reanalysis of the syntactic tree in (14a) into

the right-branching structure in (14b) in prior to the application of MPF. See Section 6.3.2 and Note 36 below.

20. In addition to this, Poser further remarks on a semantic factor as a fourth factor influencing the choice in intonational phrasing. He states: "A focused constituent always forms a minor phrase of its own" (p.155).

21. This effect shows up more clearly in (21b) than in (21a). This reflects the difference in the accentedness of the second word, or the difference in the presence or absence of accentual boost. That is, every component phrase in (21a) is accented and is raised by the boosting effect of accent whereas the second component phrase in (21b) does not receive such a boost.

22. Similar evidence is observed with other phrases in Dataset X as well as the phrases in Dataset IX (see Figures 5-51, 5-53; Figures 5.42, 5.44 in Chapter 5 respectively).

23. According to my impressionistic observation, the sentence in (22) shows an F0 pattern as the following in which the second minor phrase is realized at a higher pitch level than the first.



This sentence compares with the sentence below, which is generally realized in two major phrases with a phrase boundary placed between takoo and naokoga although we cannot readily say that there is a major syntactic boundary between the two phrases.

ta'rooga to'tta ta'koo na'okoga ta'beta

"Taro-Nom" "caught" "octopus-Acc" "Naoko-Nom" "ate"
= "Naoko ate the octopus (which) Taro caught"

24. I will propose an account of this seemingly paradoxical situation in Chapter Five, section 4.

25. hozyo-doosi differs from ordinary auxiliary verbs in that they can be used independently. In terms of the syntactic, semantic and morphological structure, this class of morphemes form a compound verb with the verb to which they are attached. In prosodic terms, however, they do not form a unified accentual phrase with the preceding verb. In other words, the sequence of a verb and a hozyo-doosi represent the kind of compounds which do not form a compound prosodically (cf. Chapter Two).

26. mo is originally an emphatic particle which highlights the elements to which it is attached. In many contexts, including the one quoted here, however, this particle can lose its emphatic function and become semantically null.
27. The three test phrases of the phrase type (24c) (=28)) happened to involve no difference in the value of PALM.
28. The four test phrases of the type in (24b) (=27)) happened to be all morphologically simplex.
29. ka in i'idesuka is a particle denoting an interrogative sentence. It is symbolized by 'Q' here.
30. The two sentences in Dataset I, i.e. those in (39), can be said to involve a tightly-bound sequence in this position since they become nearly nonsense sentences if the first phrase is omitted: no'ndara i'idesuka "would it be best to drink?" For the precise definition of 'tightly-bound' and 'loosely-bound,' see Appendix I.
31. It may be possible to define the cause and effect the other way round, that is, to suppose that the peak of the first minor phrase becomes higher as a result of total downstep. I do not favor this interpretation since it assumes that total downstep represents a different intonational structure from the ordinary case of downstep.
32. The same is probably true of the sequences of accented minor phrases. That is, other things being equal, the second minor phrase seems to involve a smaller degree of initial lowering than the first minor phrase, with the third minor phrase involving an even smaller degree of initial lowering.
33. In Chapter Five (section 2.2), I will provide further evidence that the phonological structure of a given minor phrase does not affect the F0 characteristics of its preceding minor phrase, or in other words, that the scanning of PRRs does not take place across a minor phrase boundary.
34. Alternatively, it will be possible to interpret this accentual condition on pre-accentual boost as a condition on phonetic realization rules (PRRs). Under this interpretation, PRRs are supposed to look ahead in the tonal representation of a following minor phrase only when it interprets an unaccented minor phrase. Though this interpretation can apparently provide a descriptively adequate account for the accentual condition on the process of pre-accentual boost, it cannot explain why PRRs look ahead only if the left-hand element is unaccented.

35. Typical examples are the following:

a) [kiroi [momenno ori'mono]]

"yellow" "cotton-Gen" "fabric"
= "yellow cotton fabric"

b) [[kiroi yaneno] ie'ie]

"yellow" "roof-Gen" "houses"
= "yellow-roofed houses"

36. In discussing intonational phrasing, Poser remarks that this kind of discrepancy is observed only in relative clause constructions, in which "the verb and the following head noun frequently form a single minor phrase which, however, does not include the remainder of the relative clause" (p. 153). According to my impressionistic observation, a discrepancy of this kind is not restricted to the relative clause constructions (e.g. (10d)), but is observed in left-branching phrases in general.

37. Two points should be noted with this analysis. First, 'reanalysis' defined in this way is a rather general process. This is so not just because the syntax-phonology discrepancies handled by this notion are widely observed in the process of intonational phrasing, but because the kinds of discrepancies observed in intonational phrasing are also found in accentual phrasing. In other words, the kind of reanalysis illustrated in (12) must be seen as a general process that takes place at more than one level of phonological derivation in Japanese. The other point worth emphasizing about the reanalysis under consideration is that this process requires information as to the accentual and syntactic structures of phrases. That is, since reanalysis takes place only when MPF is bound to be blocked (by the accentual or branching condition), the process must make reference to the accentual and syntactic information of phrases and sentences.

38. This point will be discussed in more depth in Chapter Five (section 5).

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Figure 4.3. Schematic comparison of the two contours in Figures 4.1 (solid line) and 4.2 (dotted line).

Figure 4.4. Illustration of the typical configuration of downsteo (solid line) compared with the configuration of the sequence in which downstep has not taken place (dotted line). Dataset VI

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amai nomi'mono "sweet drink" (dotted line).

Figures 4.5-4.7. Three typical F0 patterns shown by the sequences of an accented noun plus an accented particle(s): Dataset I & II.

Figure 4.5. The accented particle manifests both initial lowering and accentual fall.

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"That runner runs faster than this runner."

Figure 4.6. The accented particle manifests accentual fall, but not initial lowering (total downstep)

(a) the same sentence as in Figure 4.5.

(b) ro'oma-vo'ri mi'ranoe mukatta
"(She) headed for Milan from Rome"

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Figures 4.8-4.10. Three typical F0 patterns shown by the sequence of an accented verb and an accented auxiliary verb.

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Figures 4.11–4.13. Three typical F0 patterns shown by the sequence of an accented verb plus an accented hozyo-doosi

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"until Mayumi tries drinking (it)."

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ramuneo no'nde-mi'ru "(she) tries drinking lemonade"

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Figure 4.15. Typical F0 contour shown by right-branching phrases made up of three accented words (or simplex phrases):

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kowa'i me'no oma'wari
"fearful" "eye-Gen" "policeman"
= "a policeman with fearful eyes"

Figure 4.17. The second accented element shows both initial lowering and accentual fall:

na'ma-no a'yu-no nio'i
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Figures 4.18–4.19. Two typical F0 patterns of the sentence na'nino no'ndara i'idesuka "What would it be best to drink?": Dataset I.

Figure 4.18. The second phrase no'ndara manifests accentual fall but not initial lowering (total downstep).

Figure 4.19. The second phrase no'ndara manifests both initial lowering and accentual fall.

Figure 4.20. Schematic comparison of the two types of F0 patterns in Figures 1.18 (solid line) and 1.19 (dotted line).

Figures 4.21–4.22. Two typical F0 patterns shown by the sentence ittai na'nio no'ndara i'idesuka "What on earth would it be best to drink?": Dataset II.

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Figure 4.22. The second accented phrase no'ndara manifests both initial lowering and accentual fall.

Figure 4.23. Schematic comparison of the averaged F0 contours shown by the two sentences illustrated in Figures 4.18–19 and Figure 4.21–4.22.

Dotted line: na'nio no'ndara i'idesuka
"What would it be best to drink?"

Solid line: ittai na'nio no'ndara i'idesuka
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Figure 4.26. [[naomino [ueno aneno]] yunomi]
"Naomi's eldest sister's teacup"

Figure 4.27. [naomino [[umeno irono] yunomi]]
"Naomi's plum-colored teacup"

Figure 4.28 [naomino [omoi [marui yumomo]]]
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Figure 4.33. amai yamaimo "sweet yam"

Figure 4.34. uma'i nomi'mono "tasty drink"

Figure 4.35. uma'i yamaimo "tasty yam"

Figure 4.36. Schematic comparison of the F0 contours in Figures 4.32 (solid line) and 4.33 (dotted line).

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Figure 4.40. Right branching phrases:
[-A,+A,+A] (solid line) vs. [-A,-A,+A] (dotted line)

Figure 4.41. Left-branching phrases:
[-A,+A,+A] (solid line) vs. [-A,-A,+A] (dotted line)

Figure 4.42. Schematic comparison of the two-types of branching structures in Dataset VIII:

The right-branching phrase o'okina omoi me'ron
"a big heavy melon" (solid line)
vs. the left-branching phrase o'okina mimino o'okami
"a wolf with big ears" (dotted line)

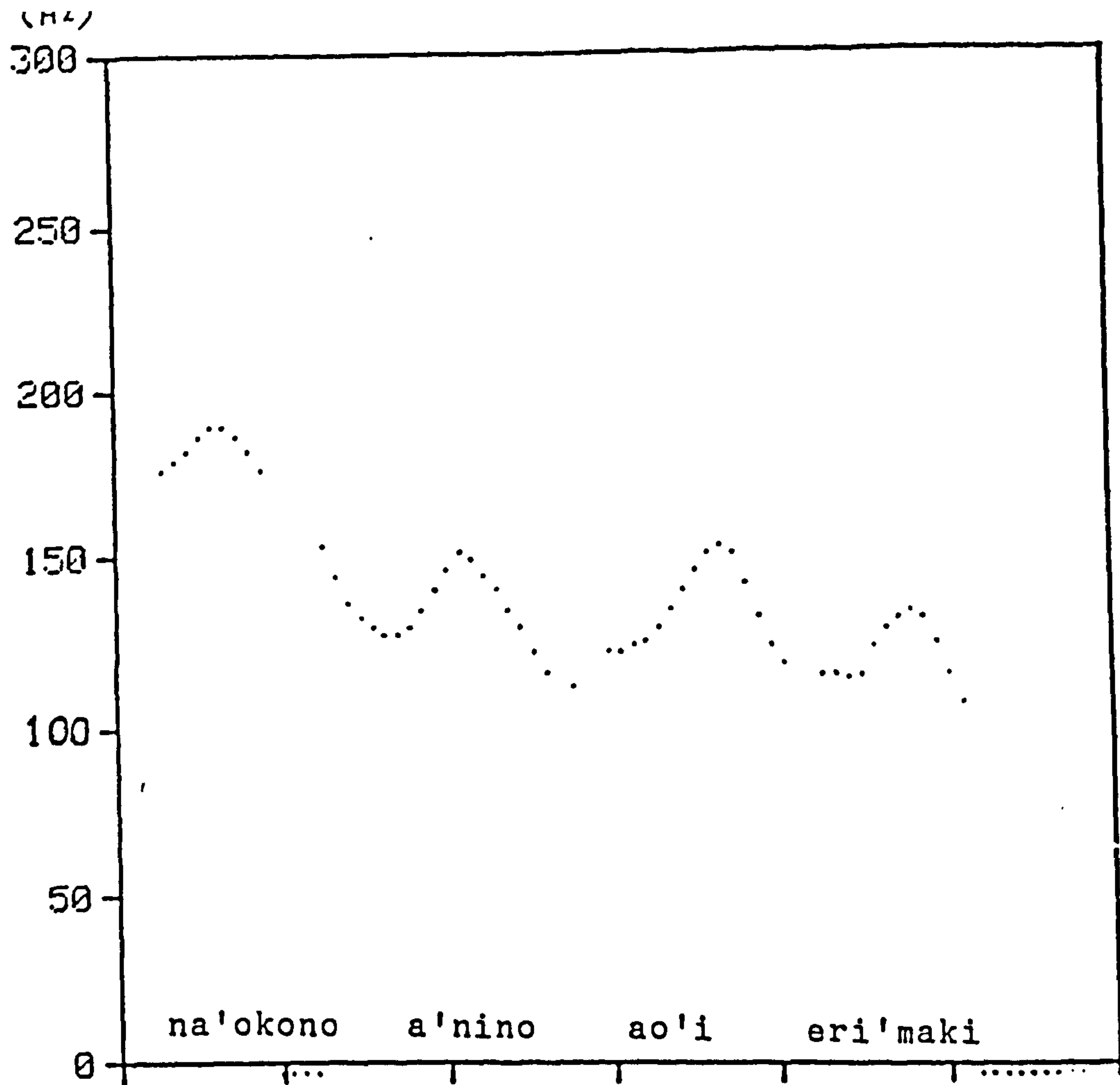


Figure 4.1

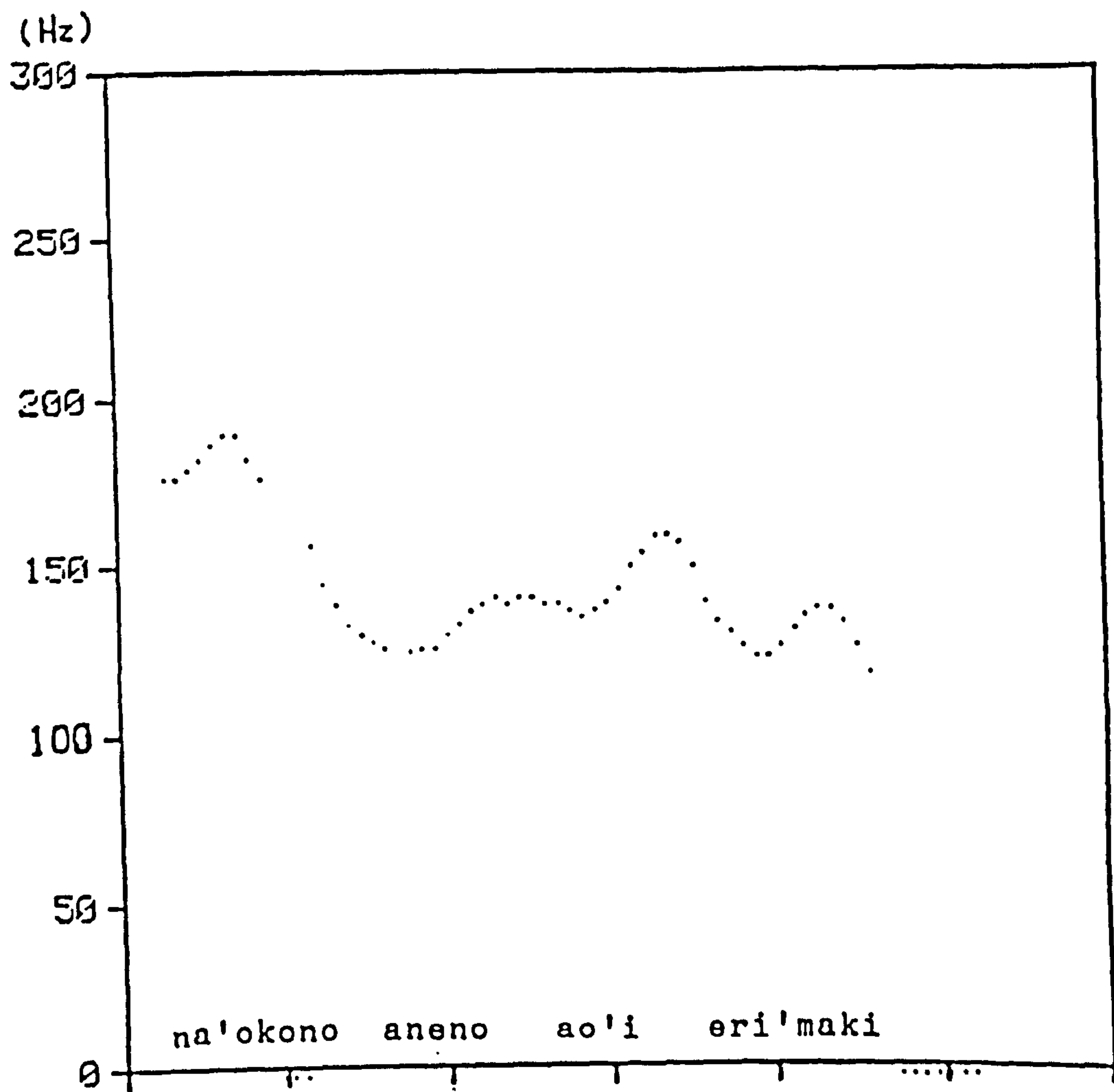


Figure 4.2

Dataset X

— + + + +

na^ookono

a^onino

ao^oi

ma^ohura

+ - + +

na^ookono

aneno

ao^oi

ma^ohura

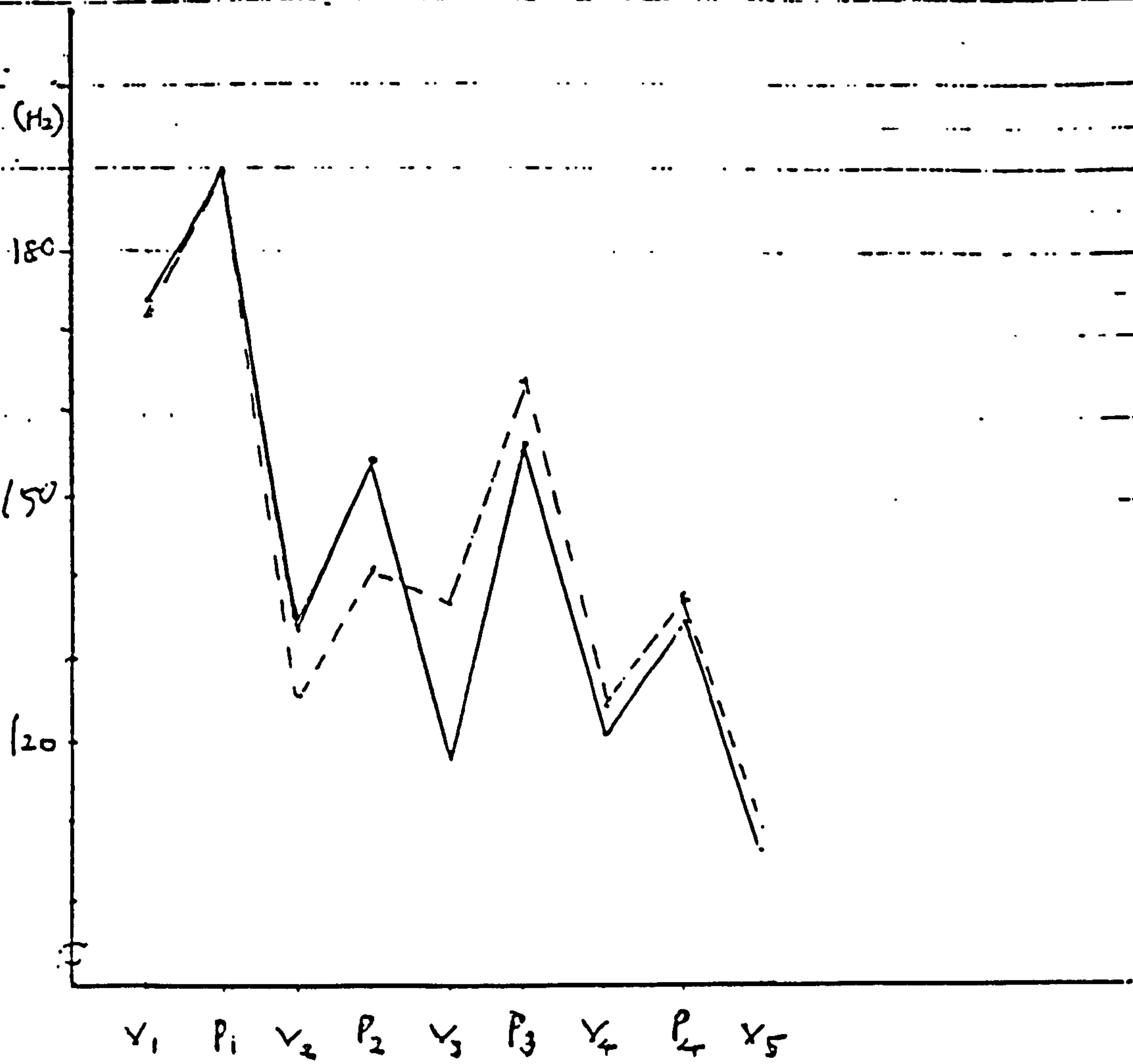


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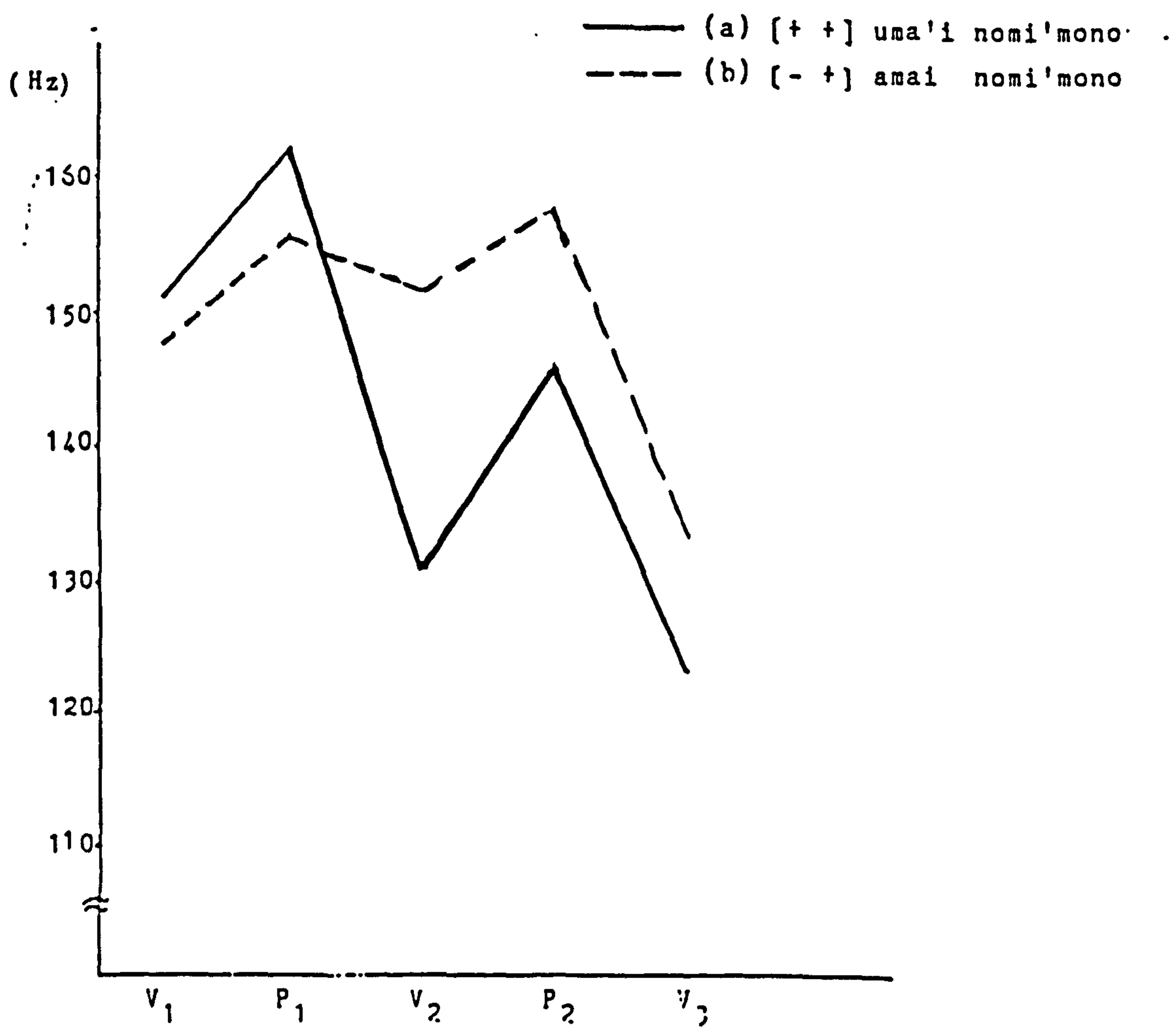


Figure 4. 4

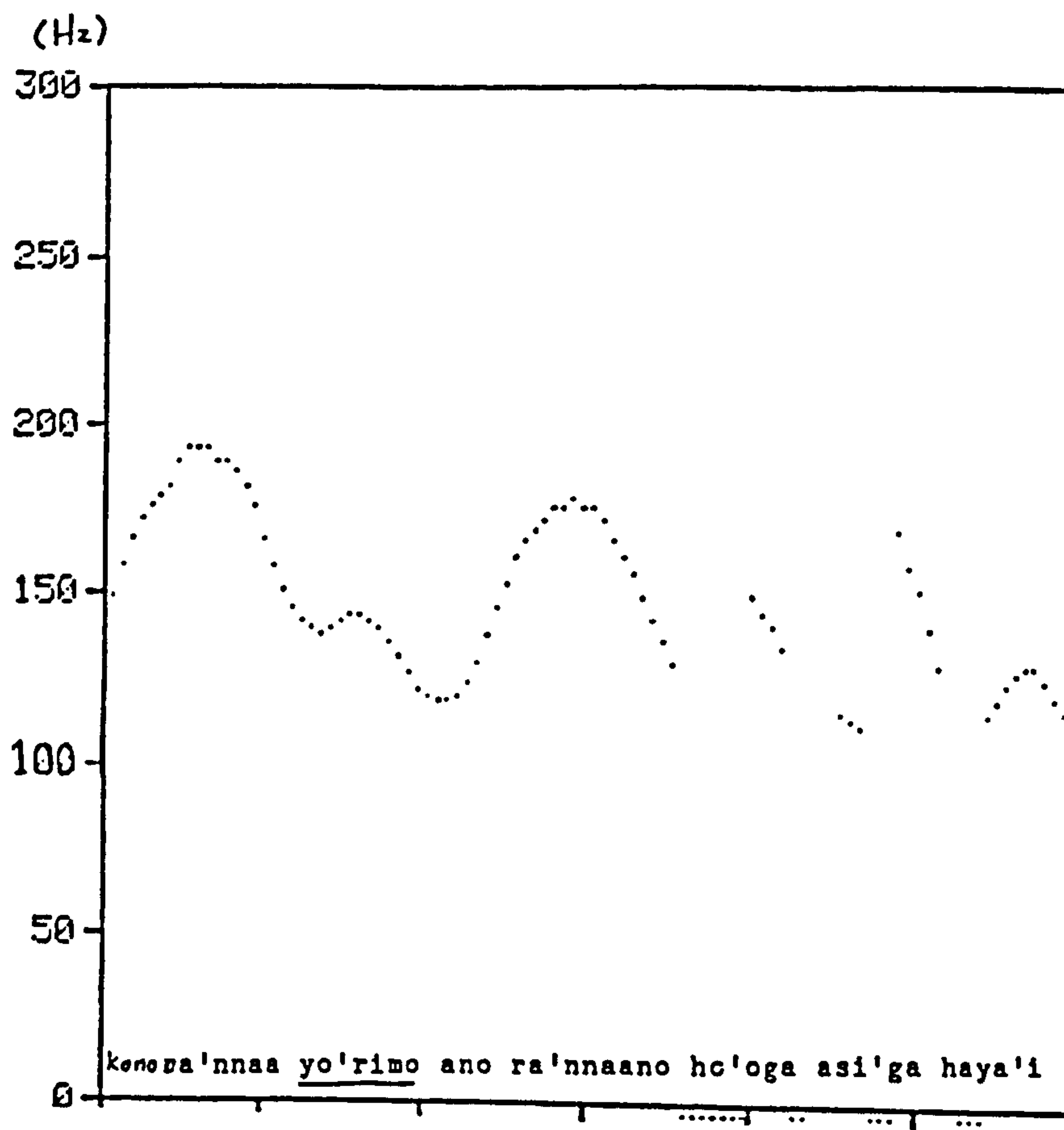


Figure 4.5

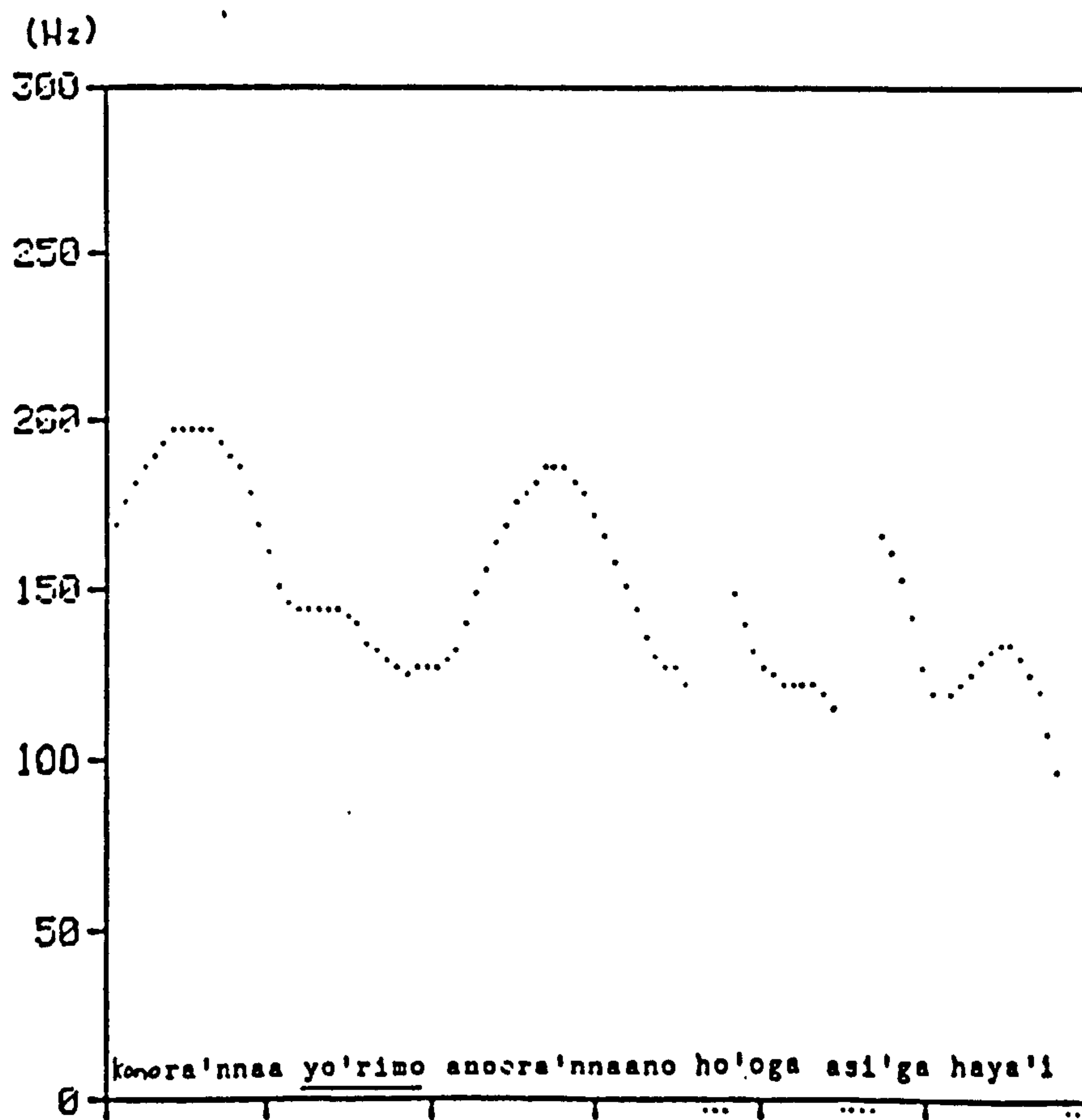


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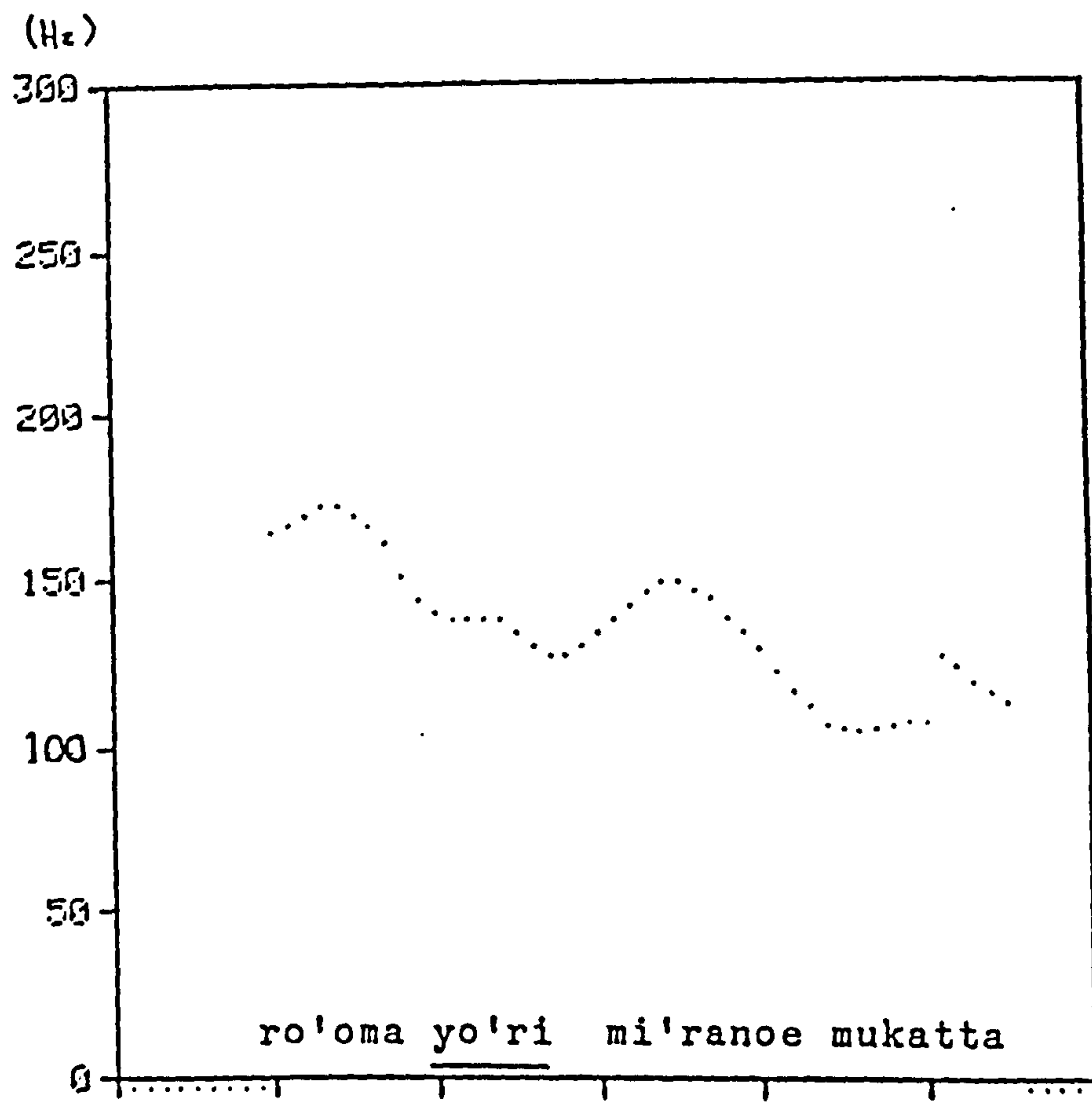


Figure 4.6 (b)

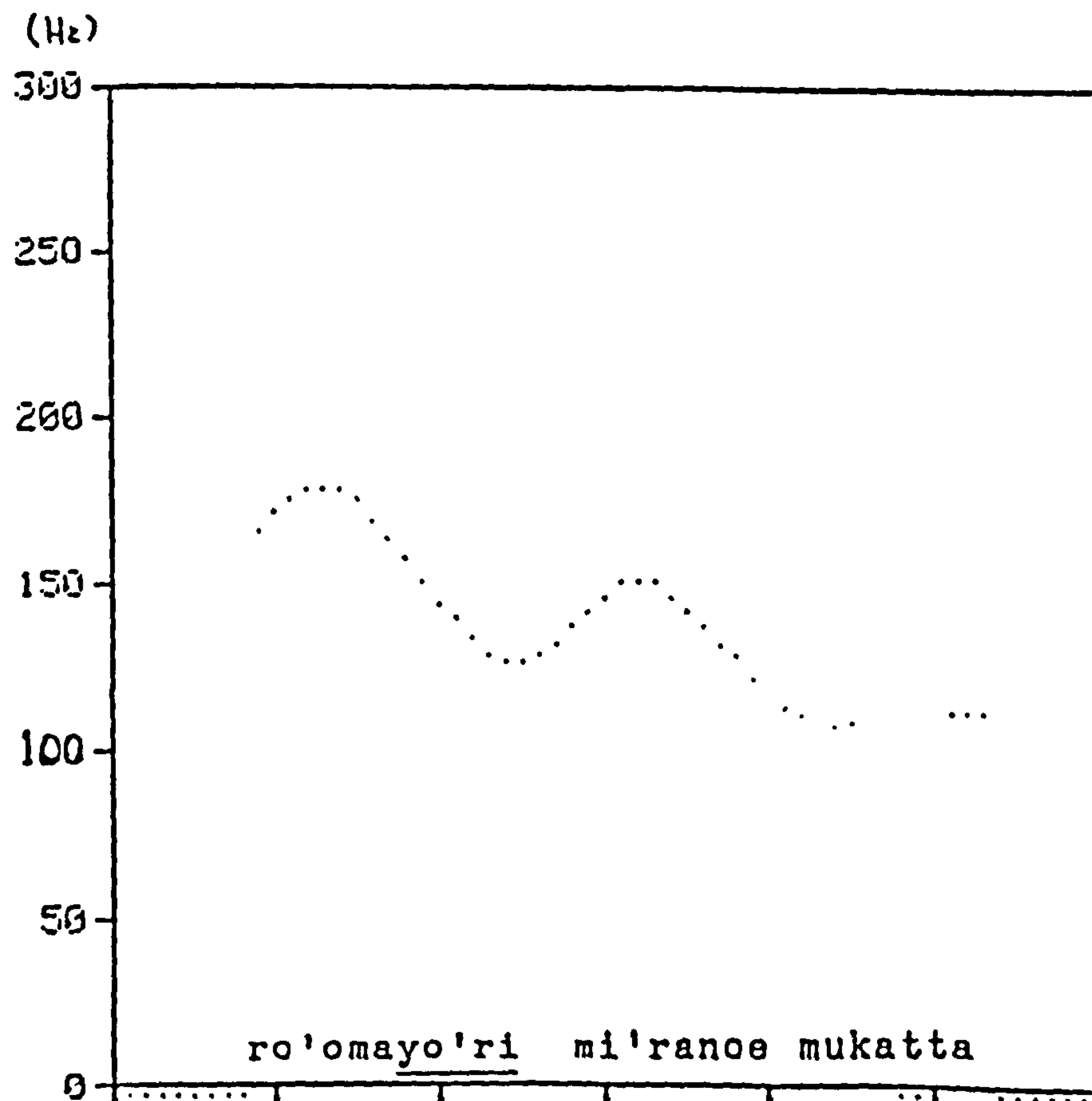


Figure 4.7

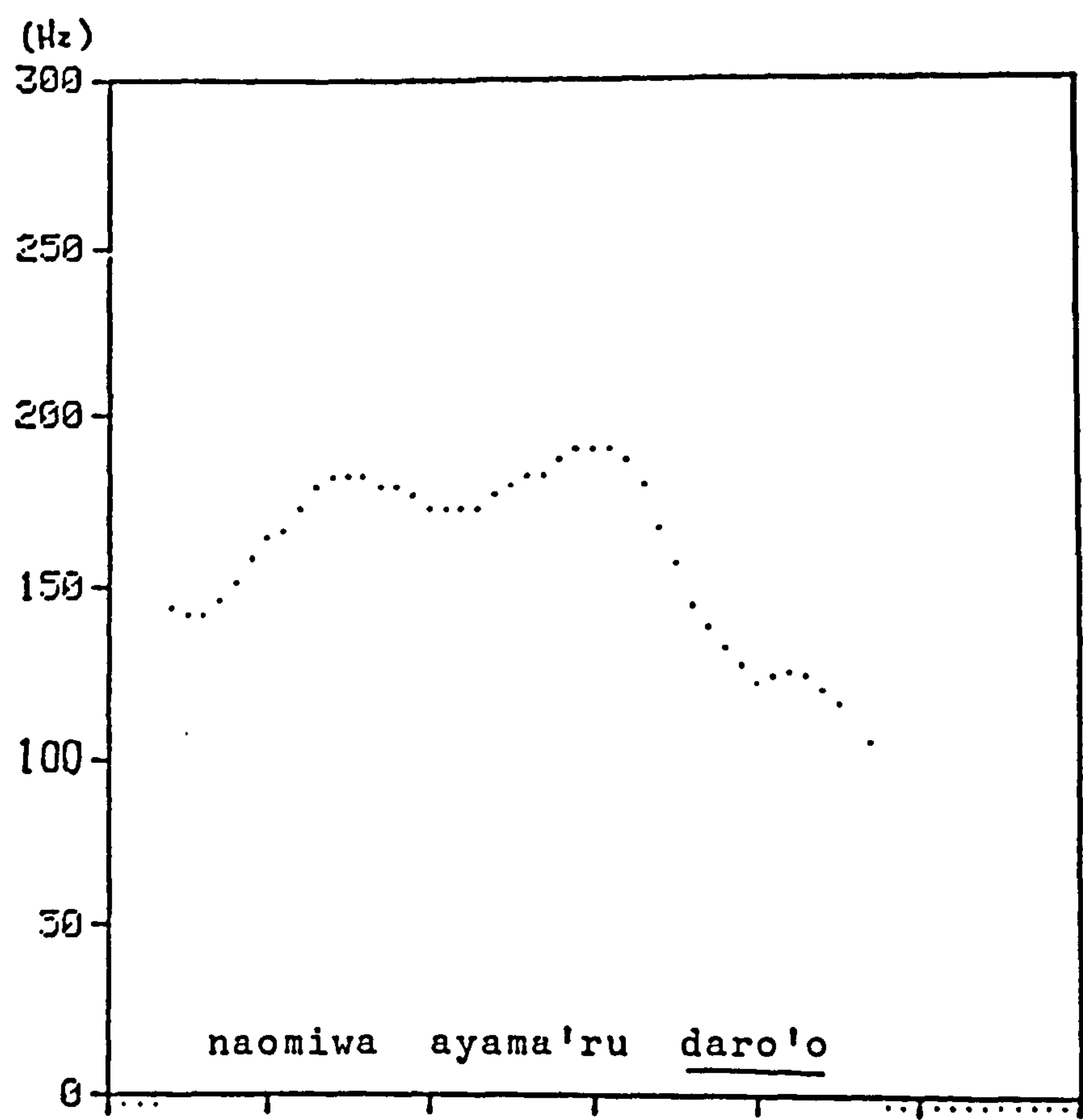


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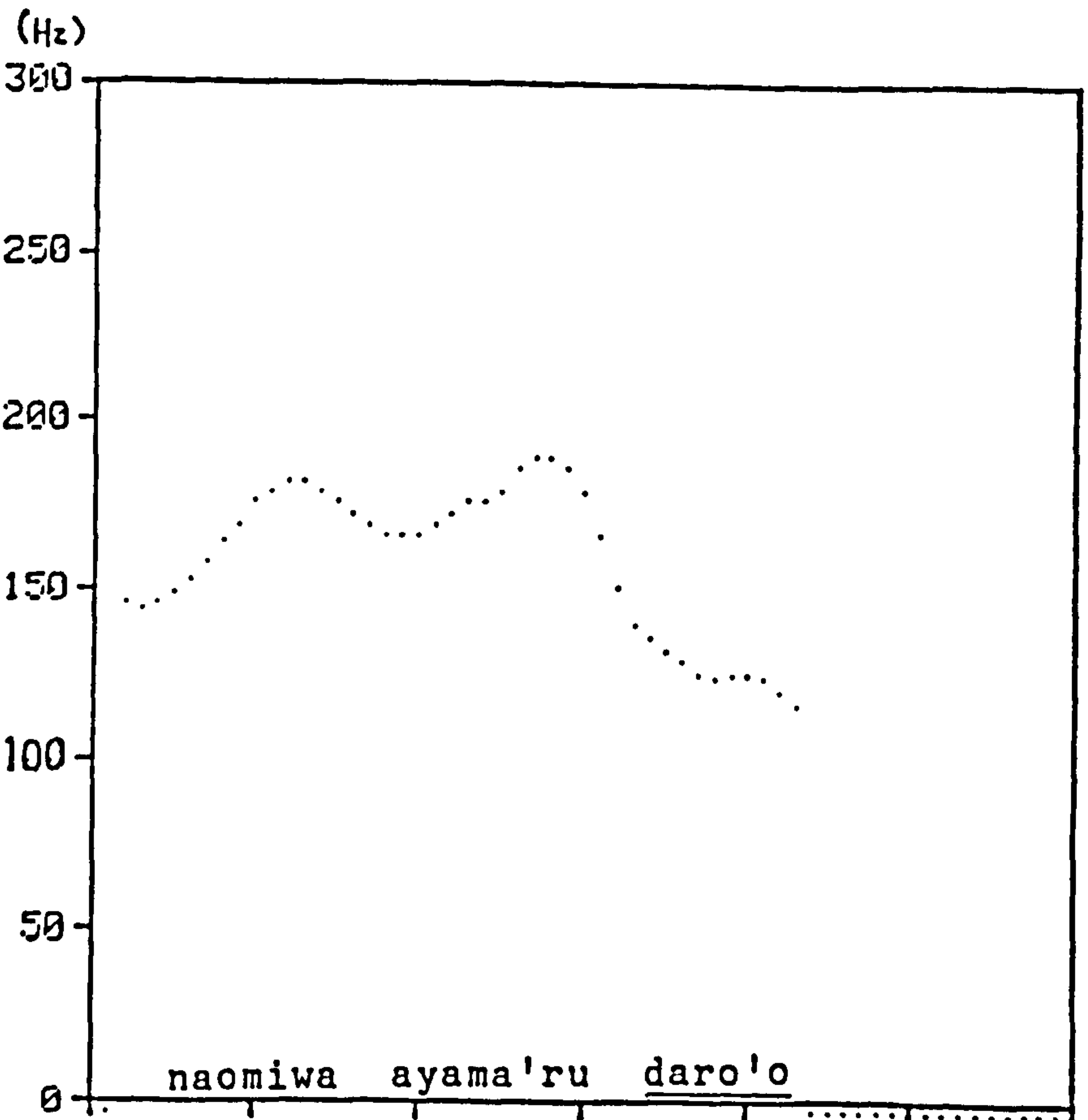


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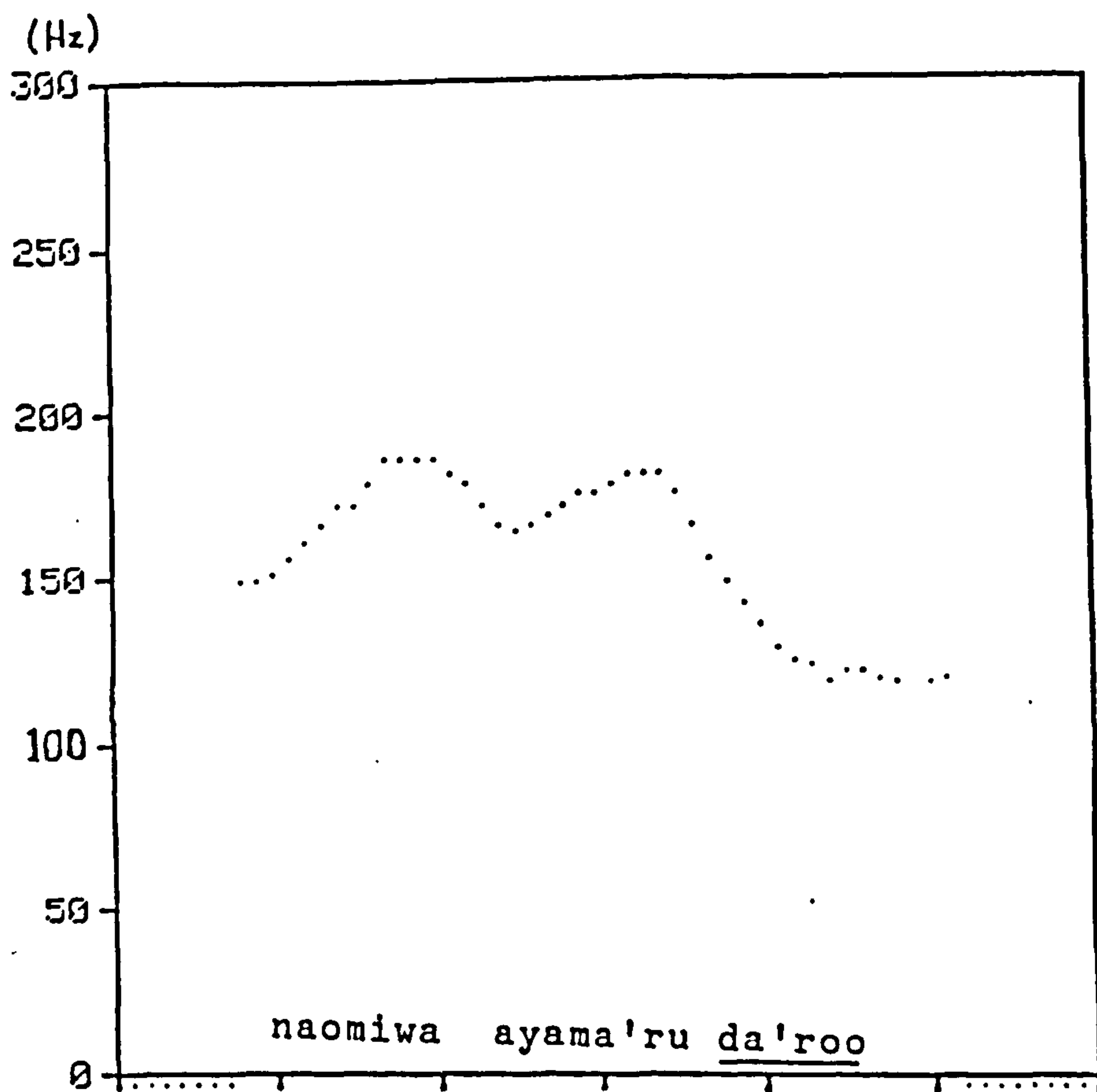


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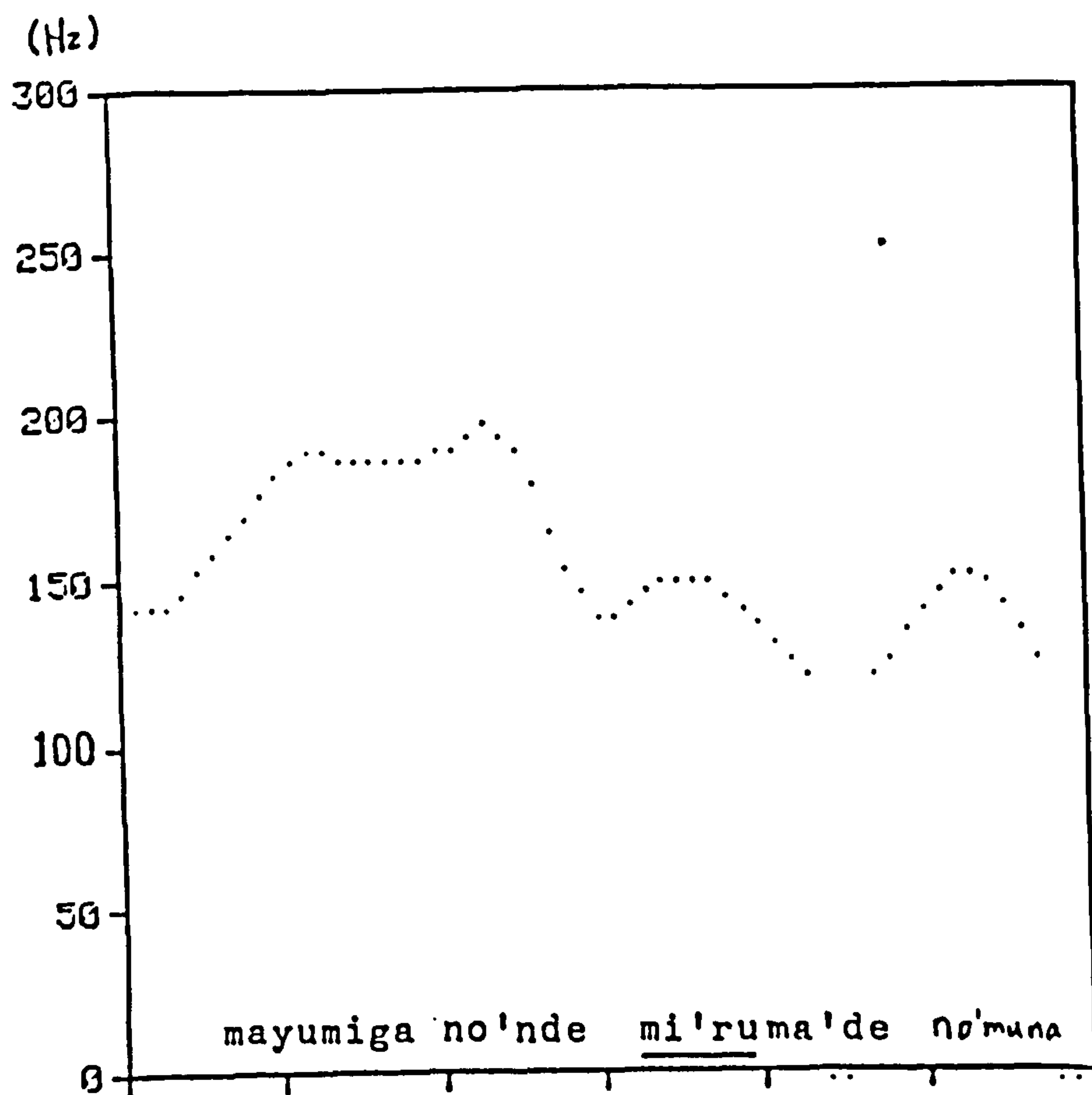


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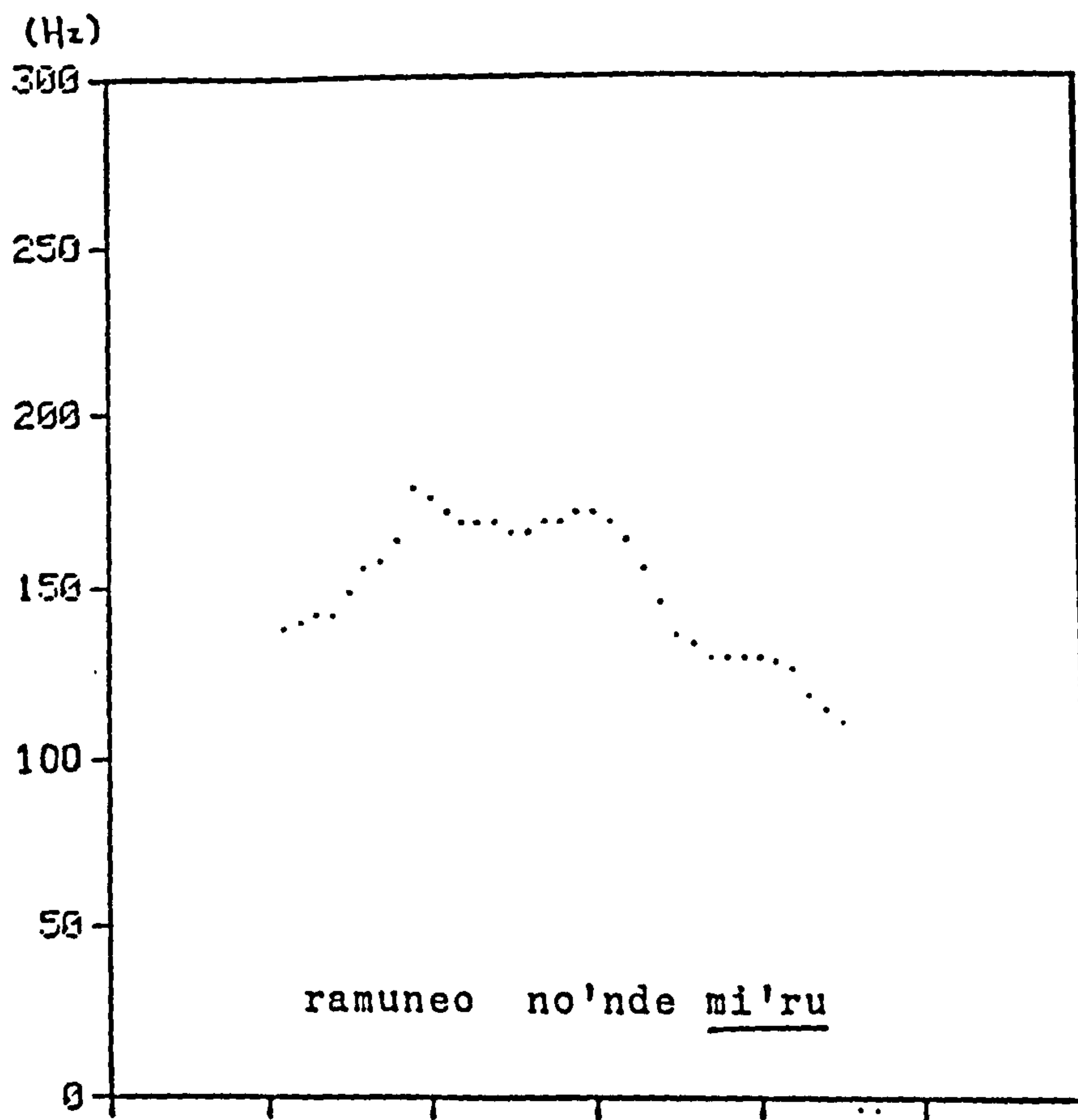
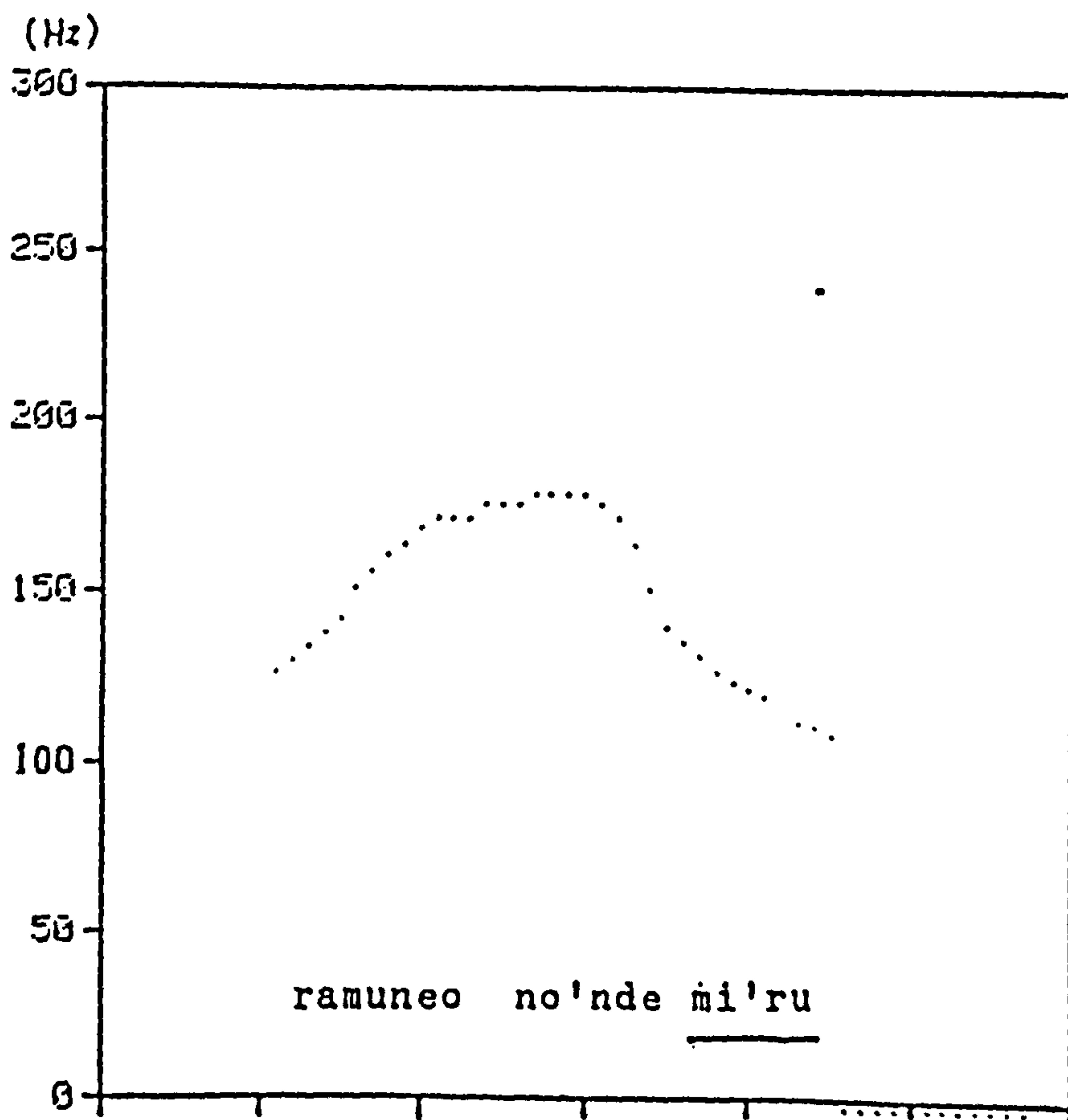


Figure 4.12



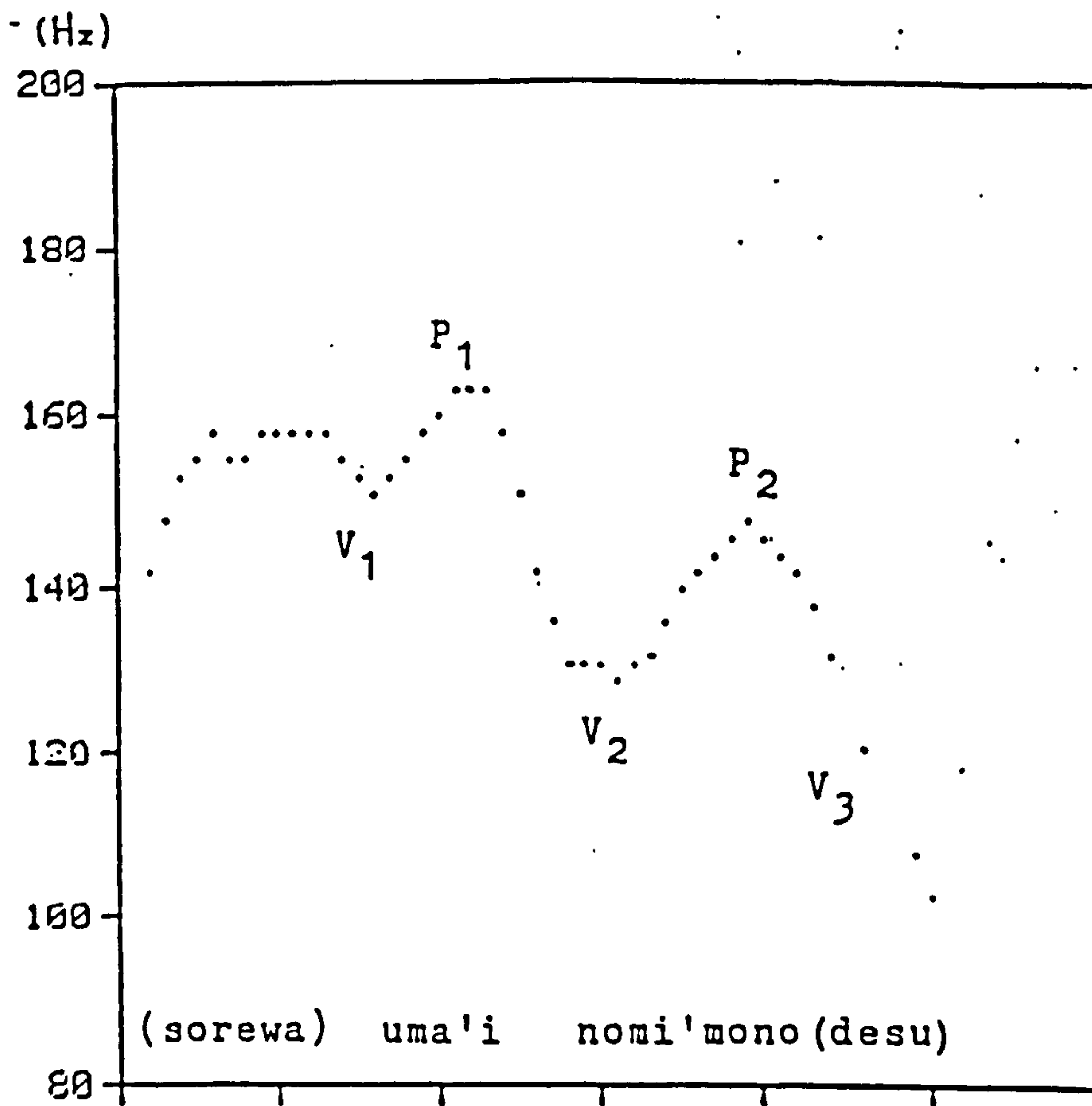


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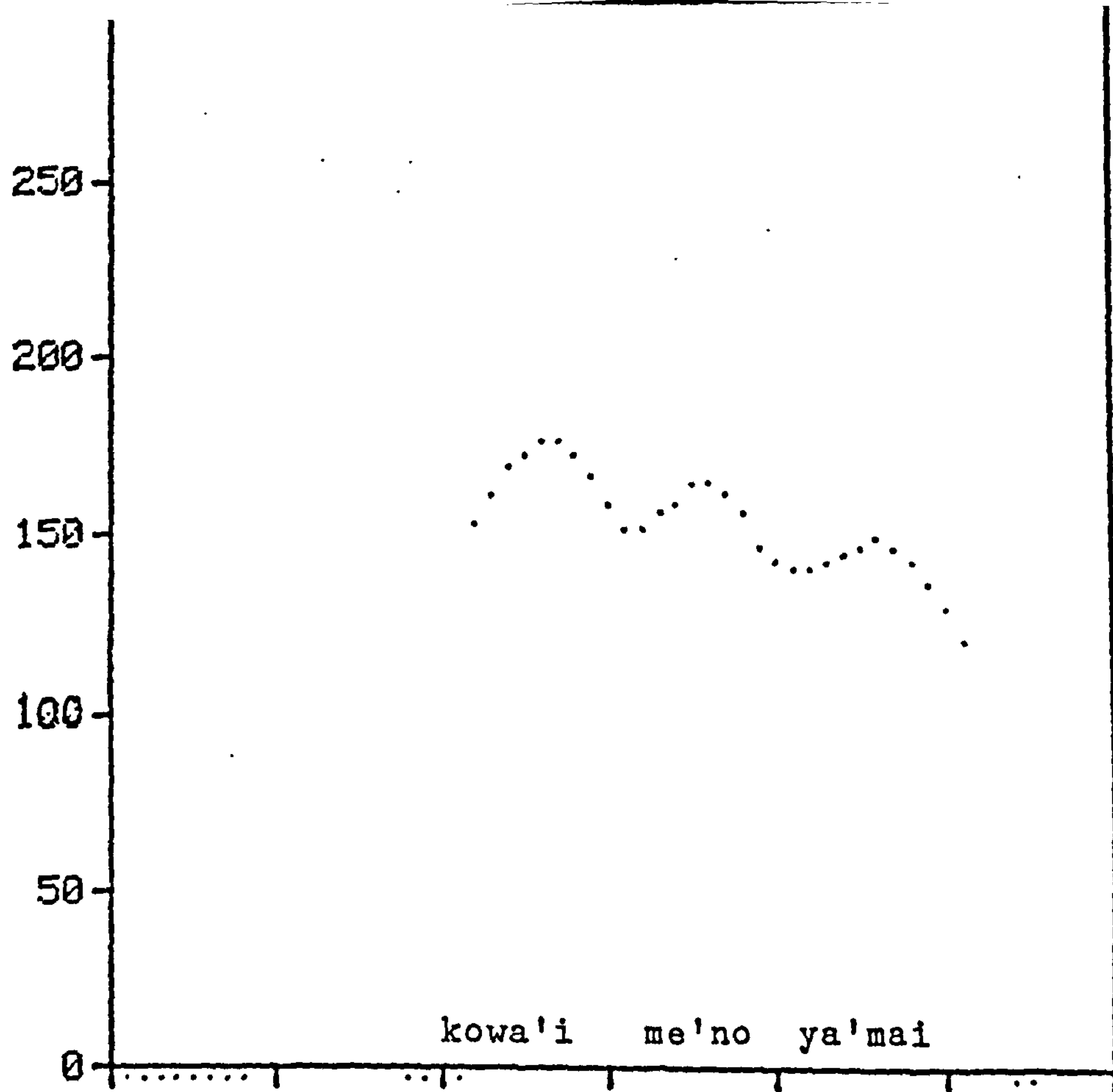


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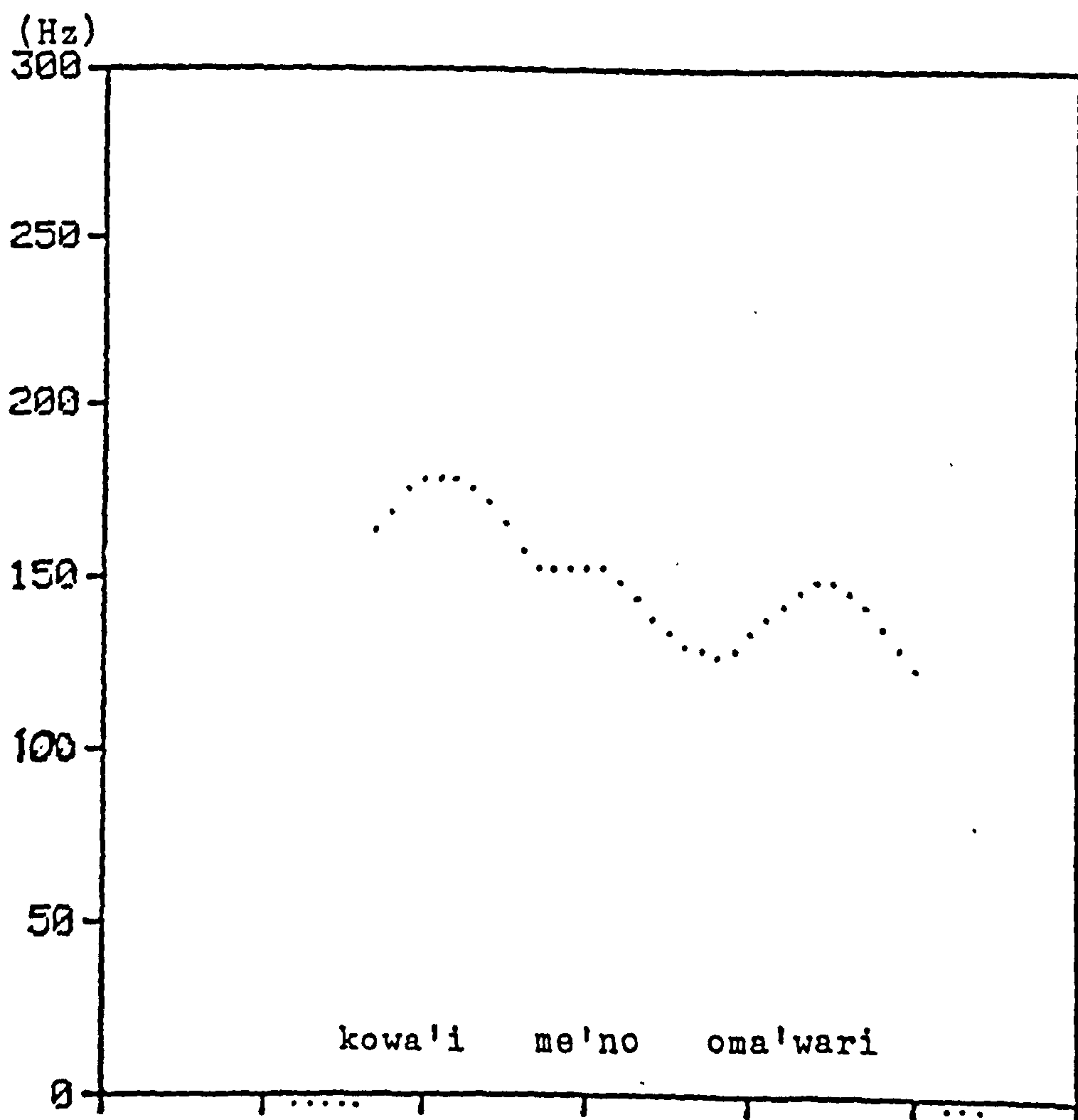


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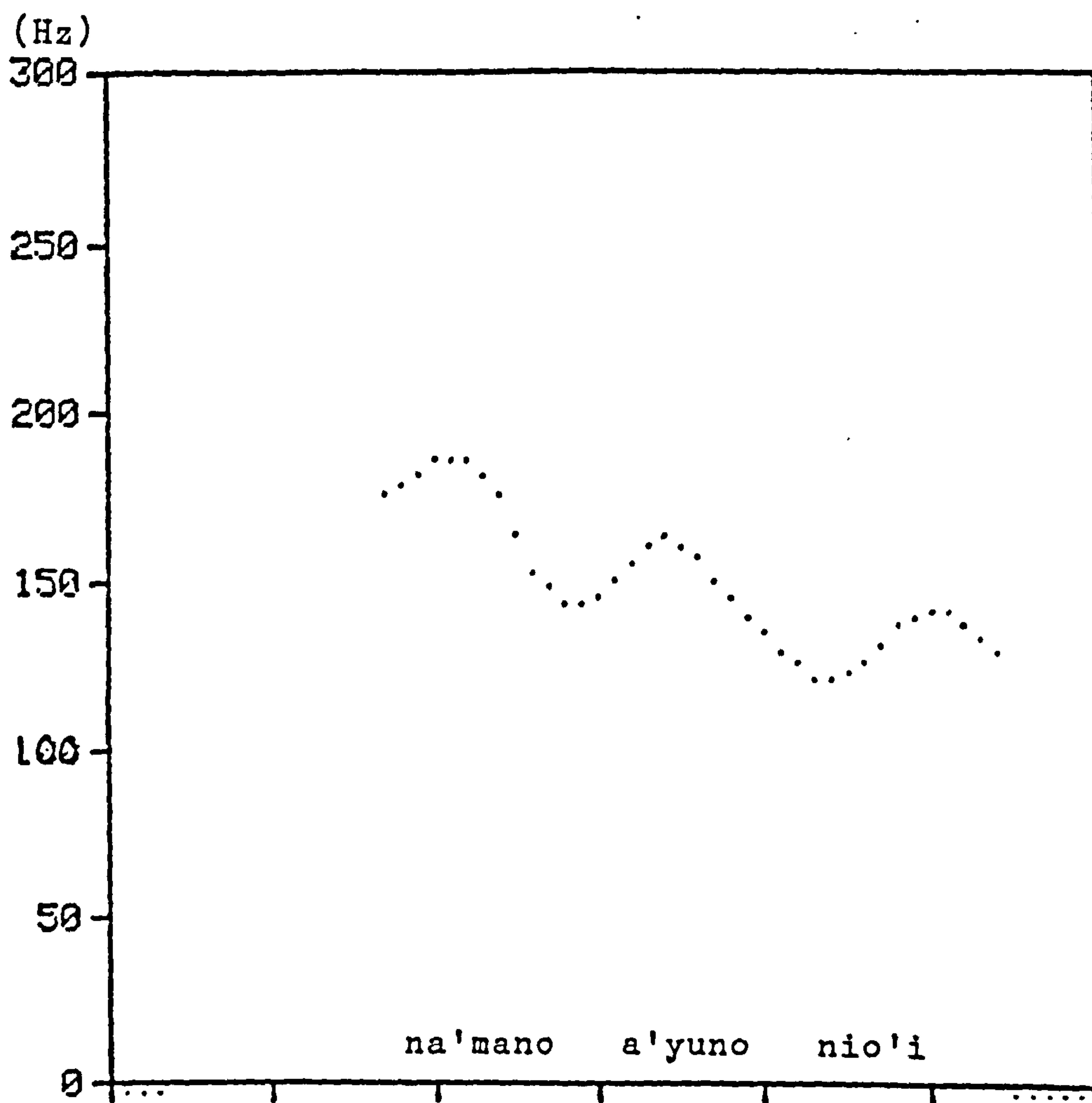


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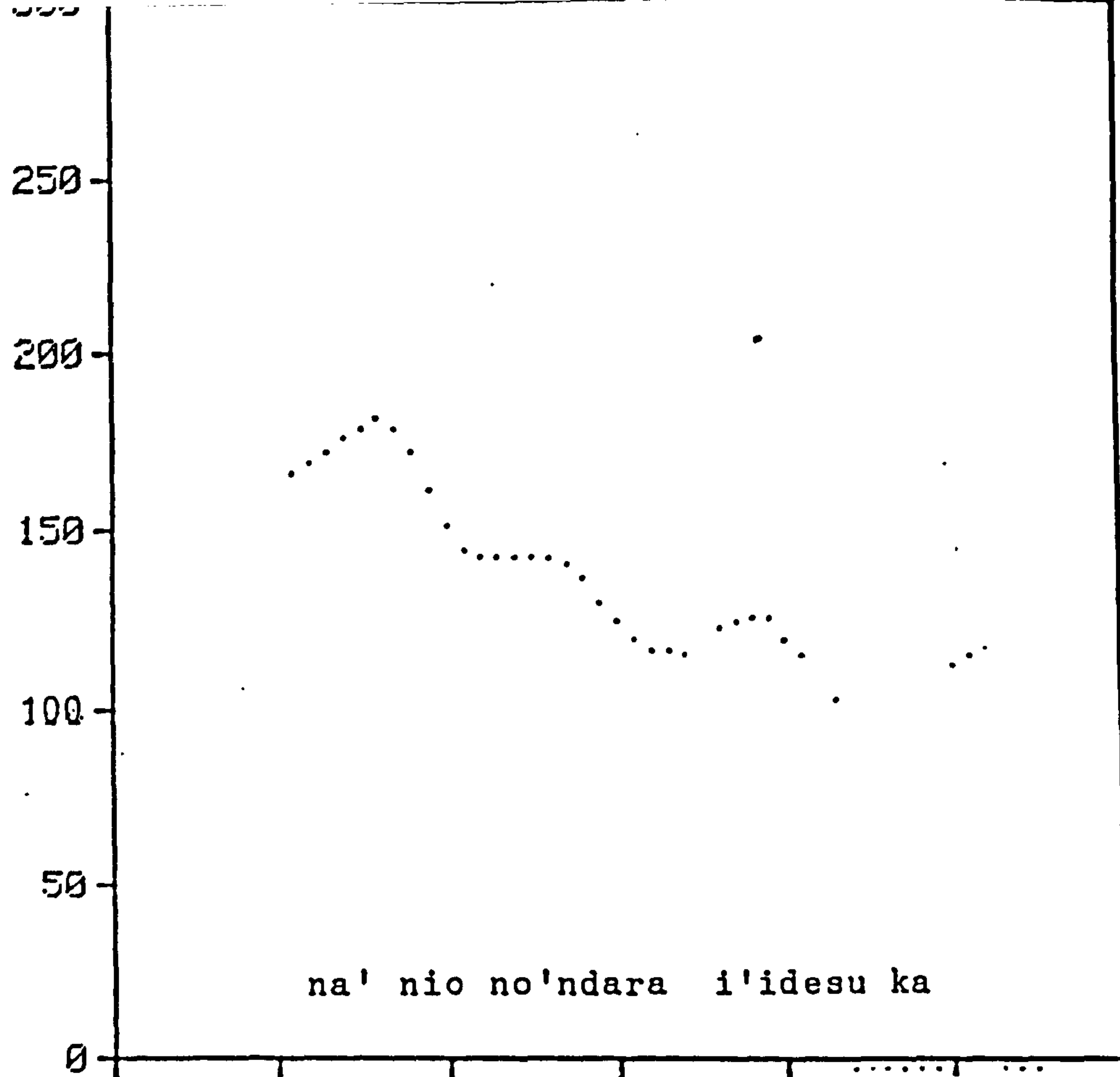


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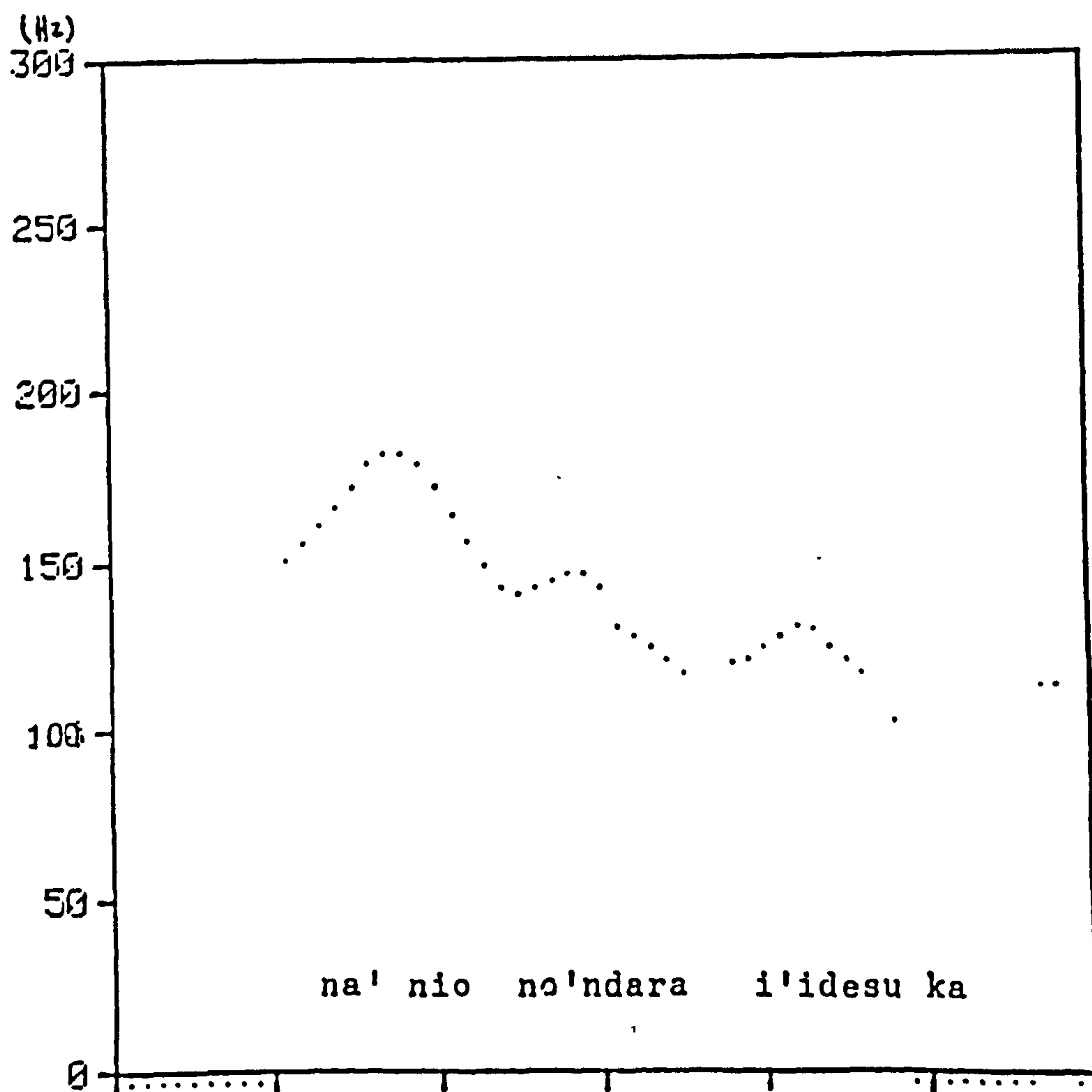


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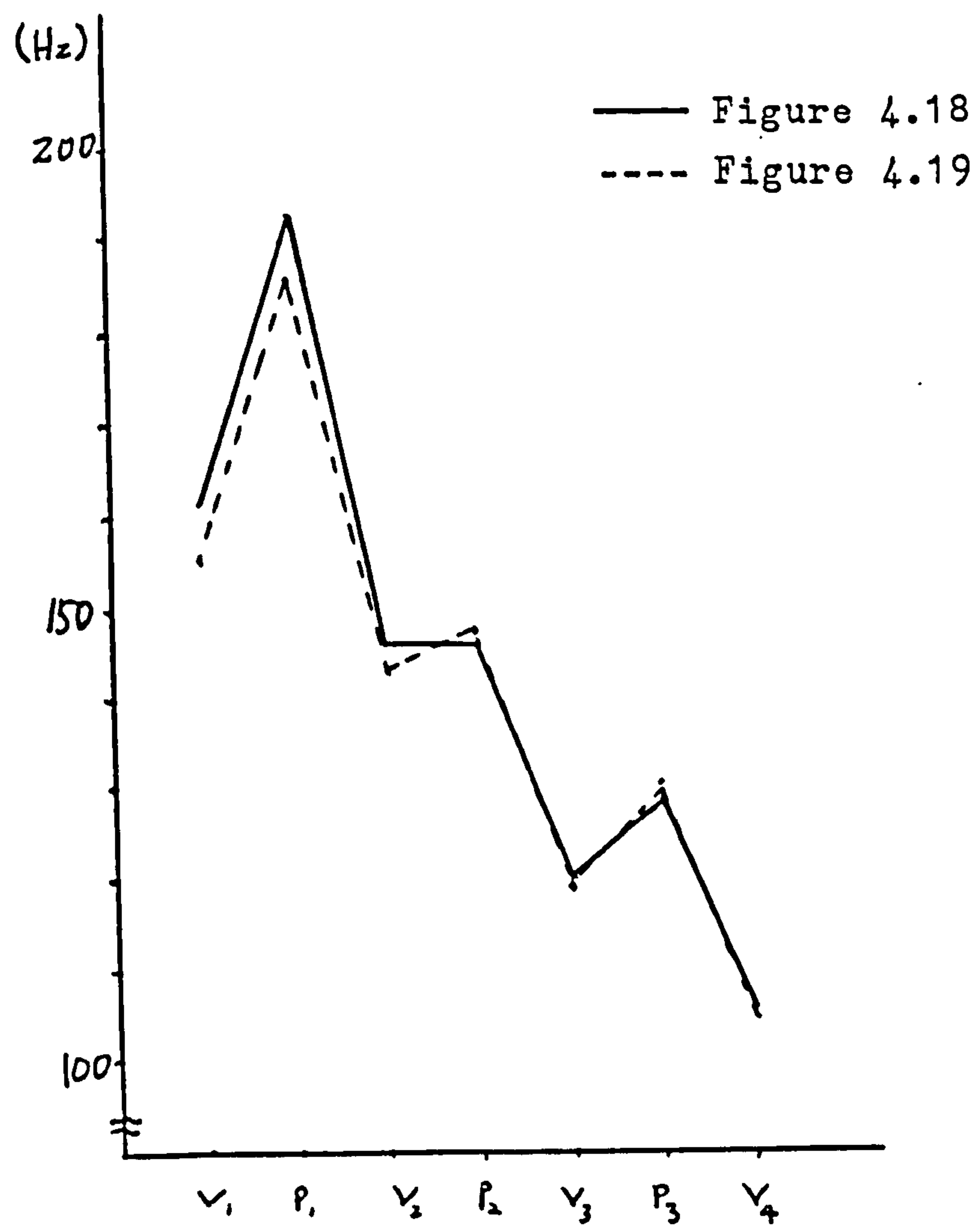


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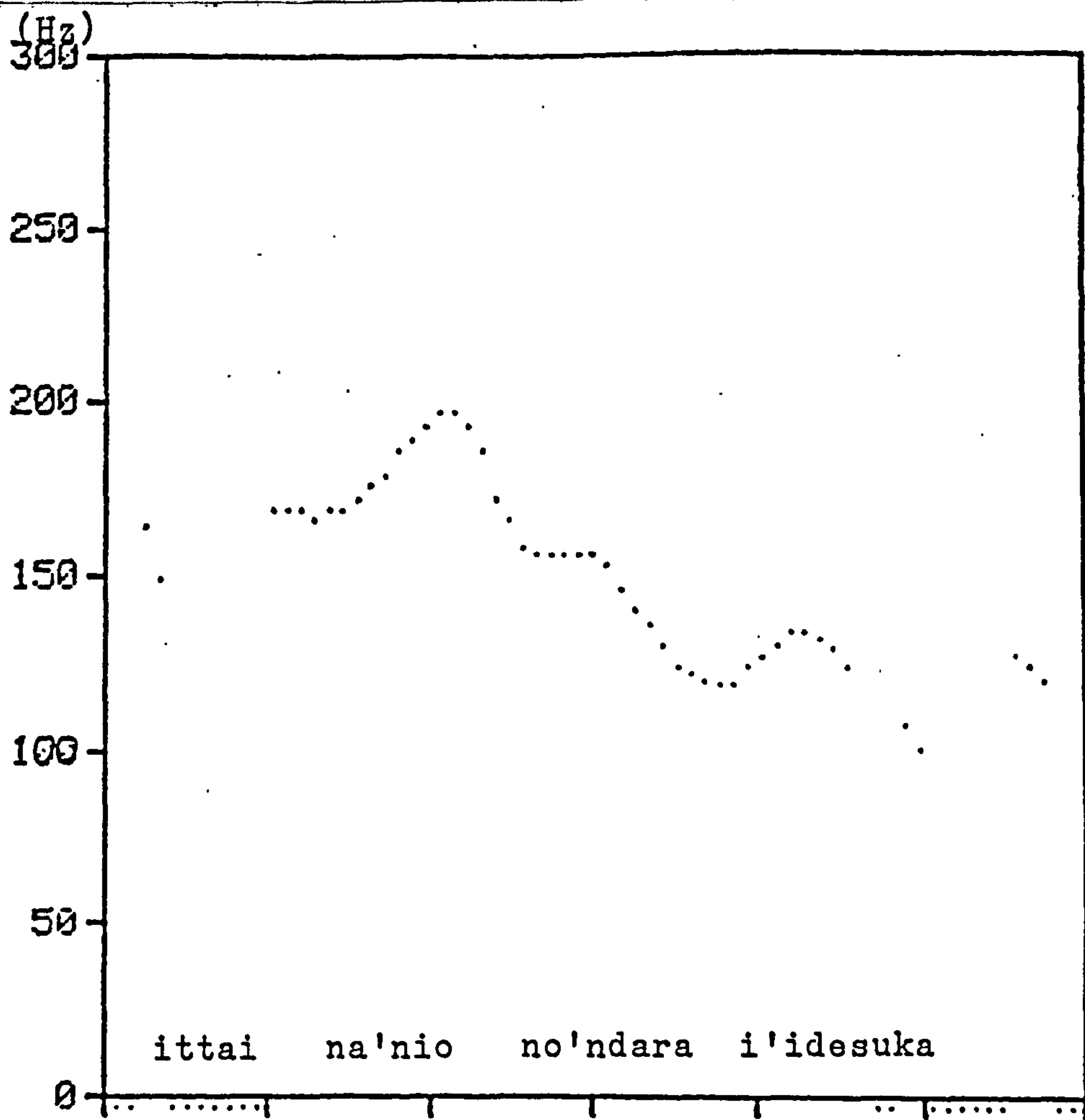


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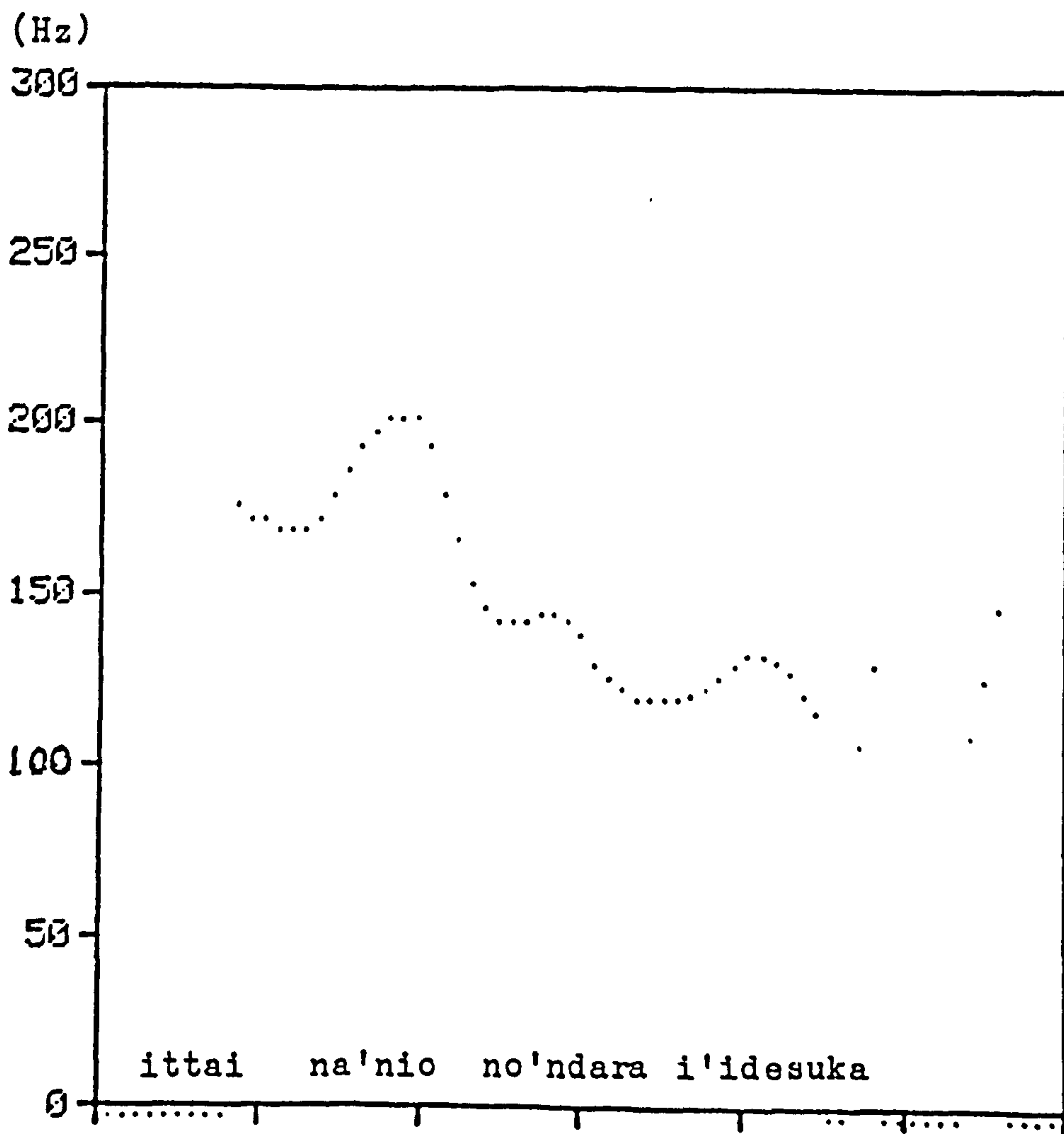


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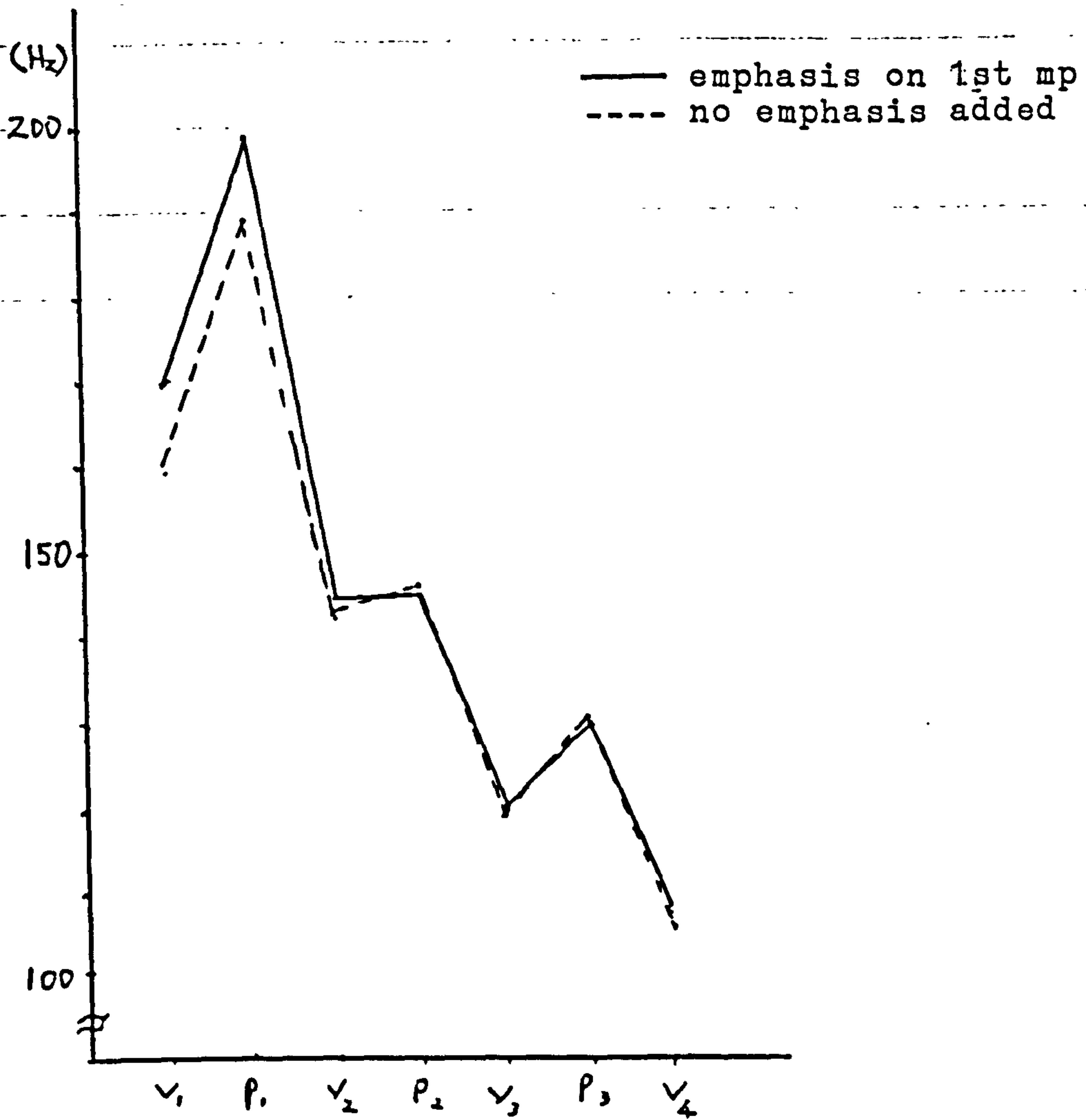


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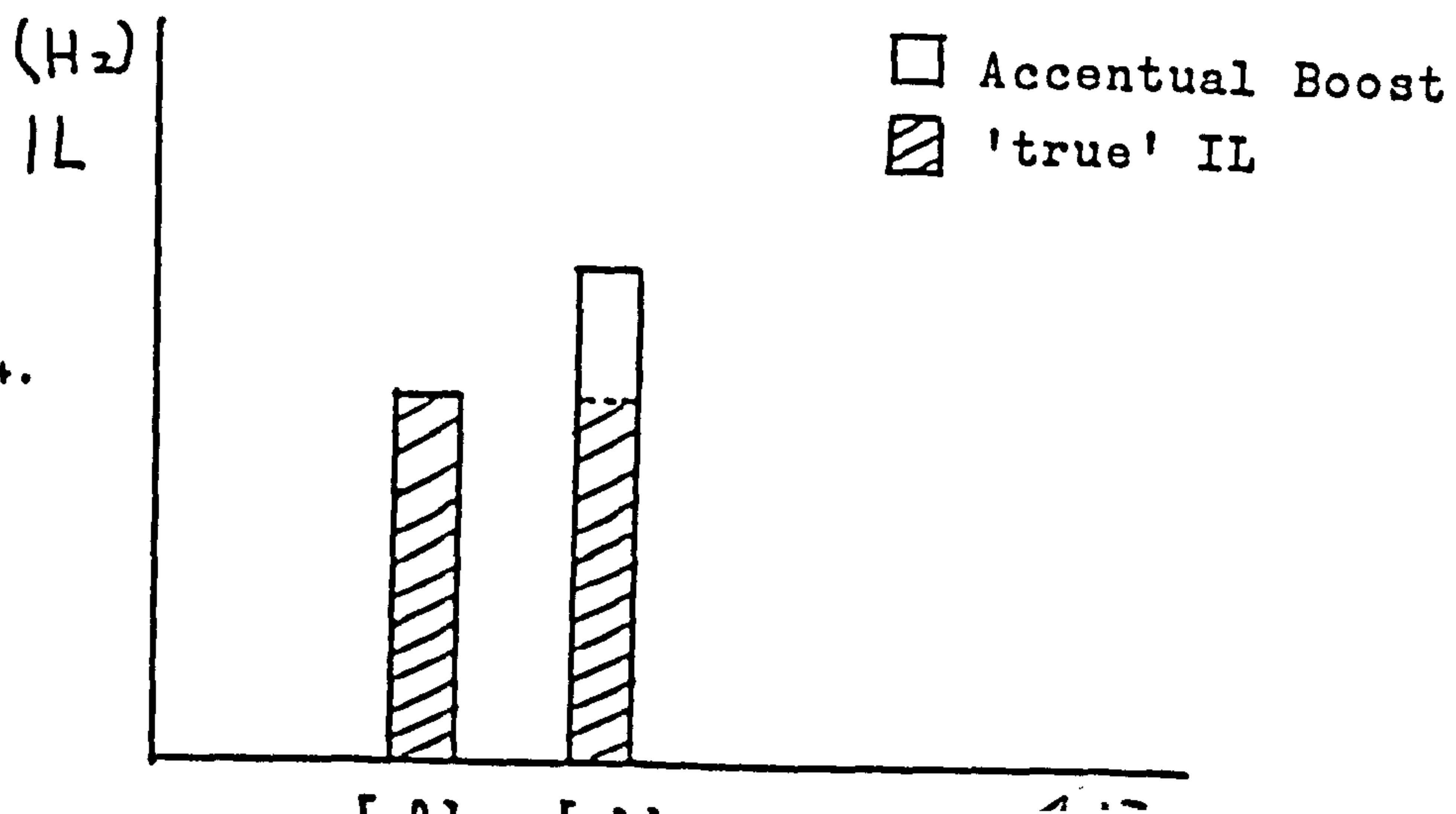


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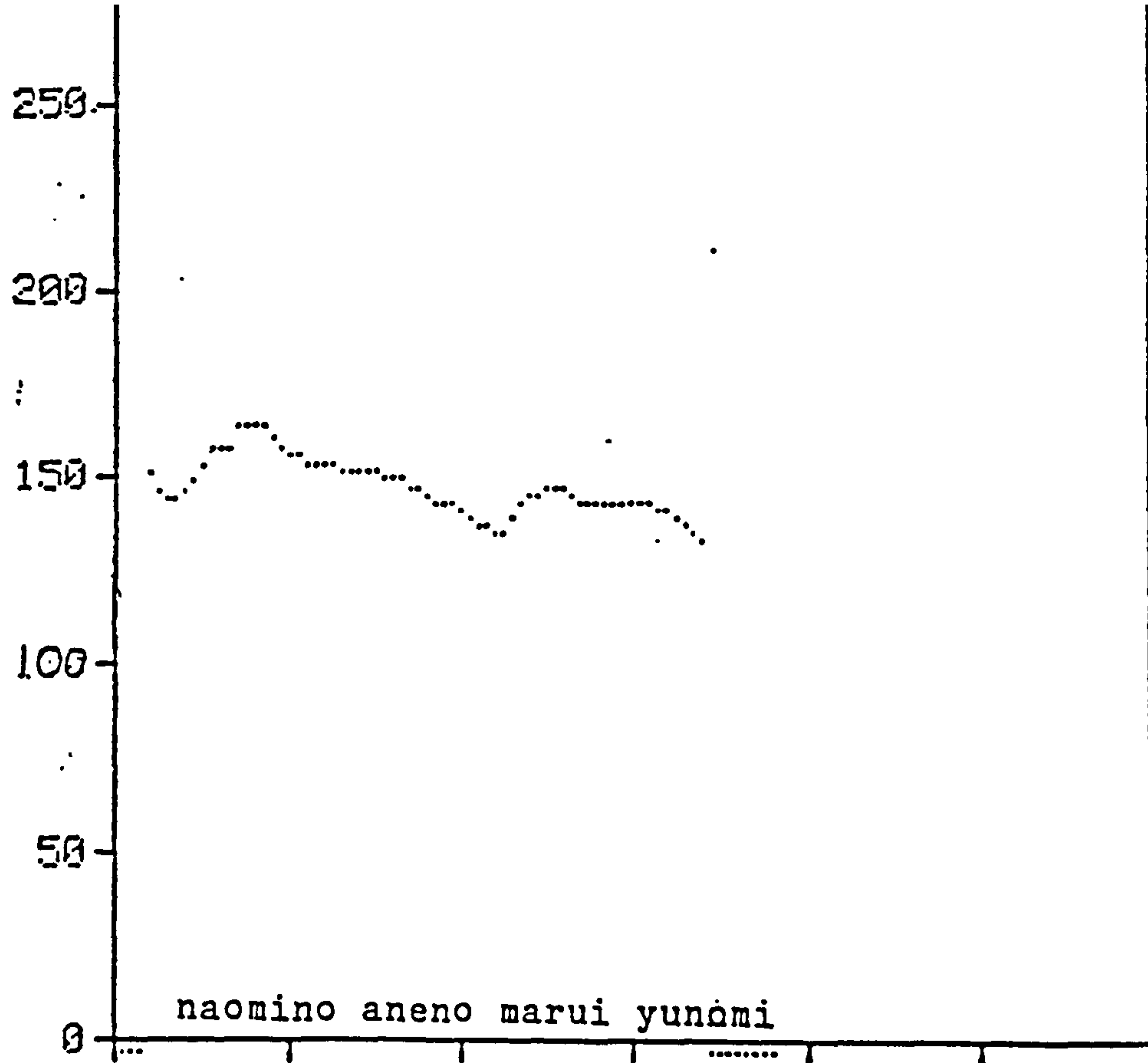


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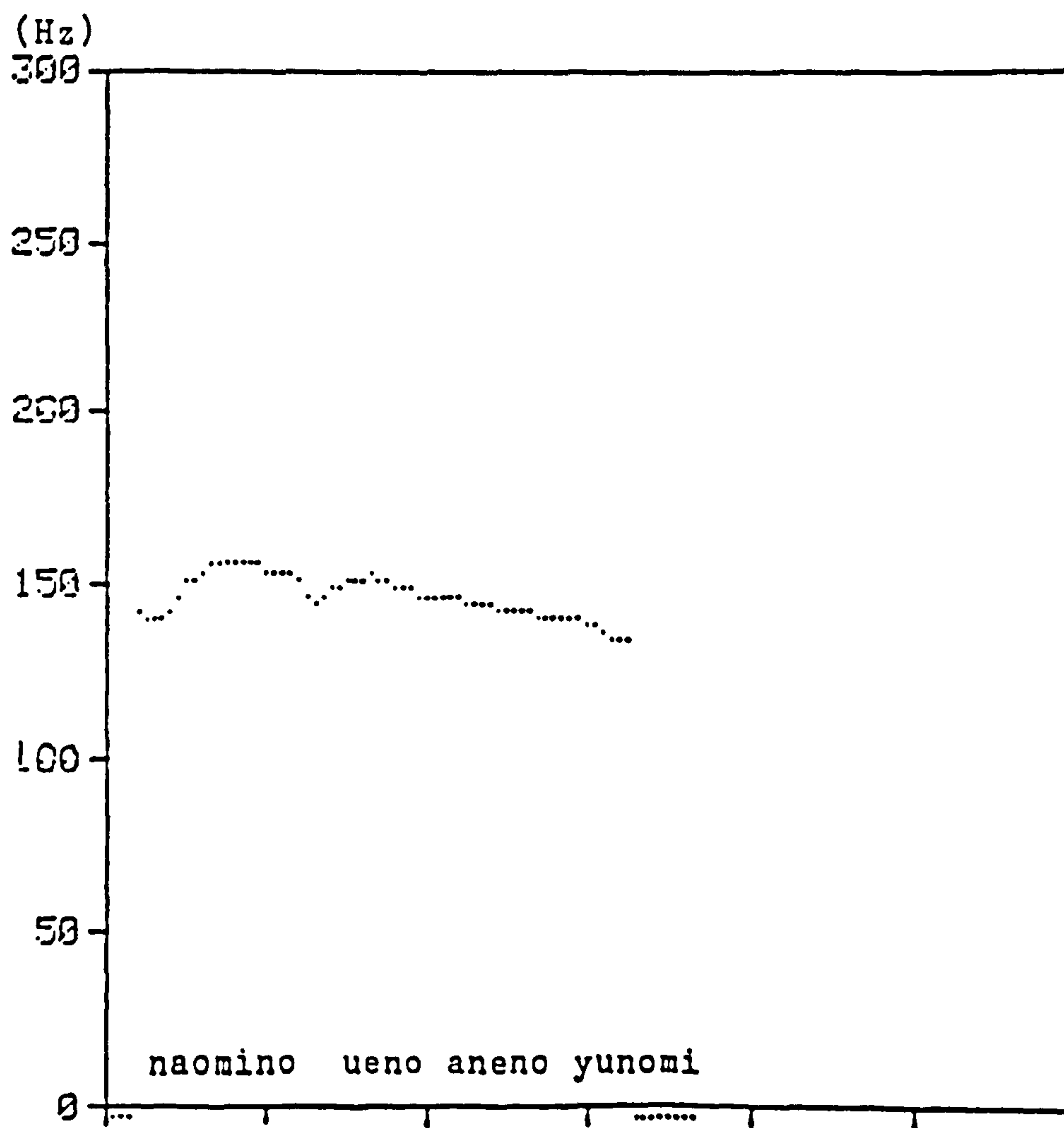


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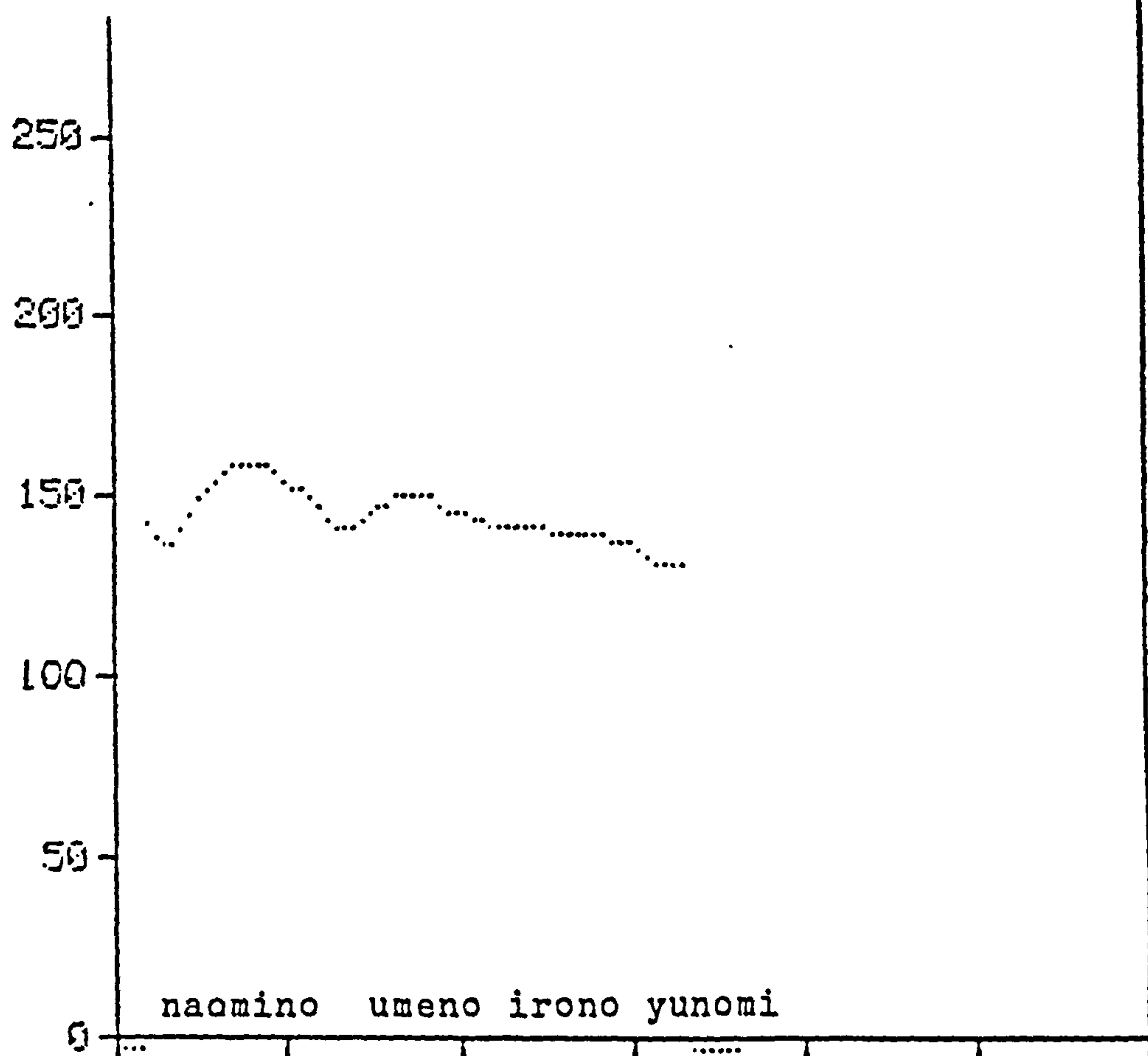


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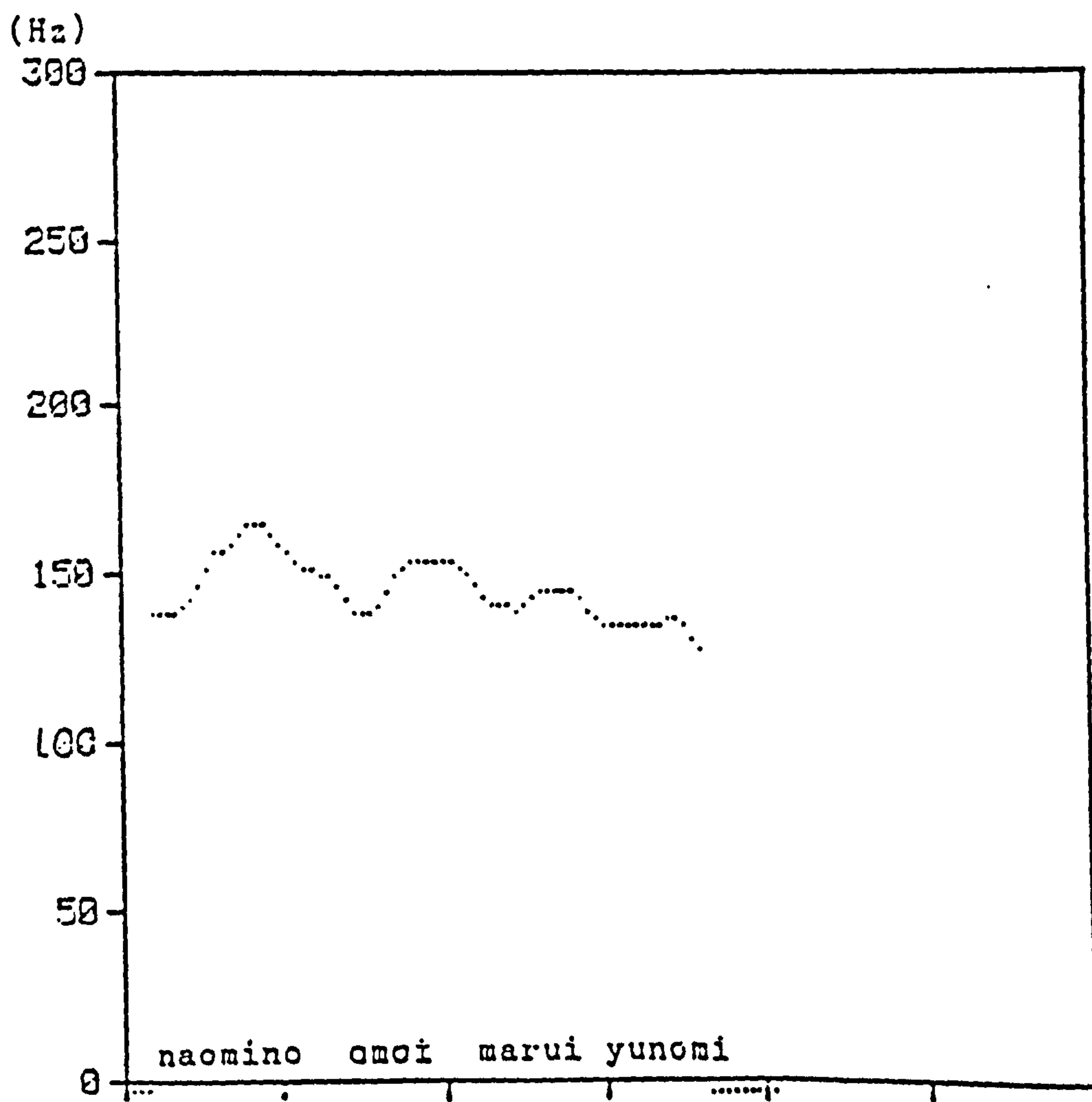


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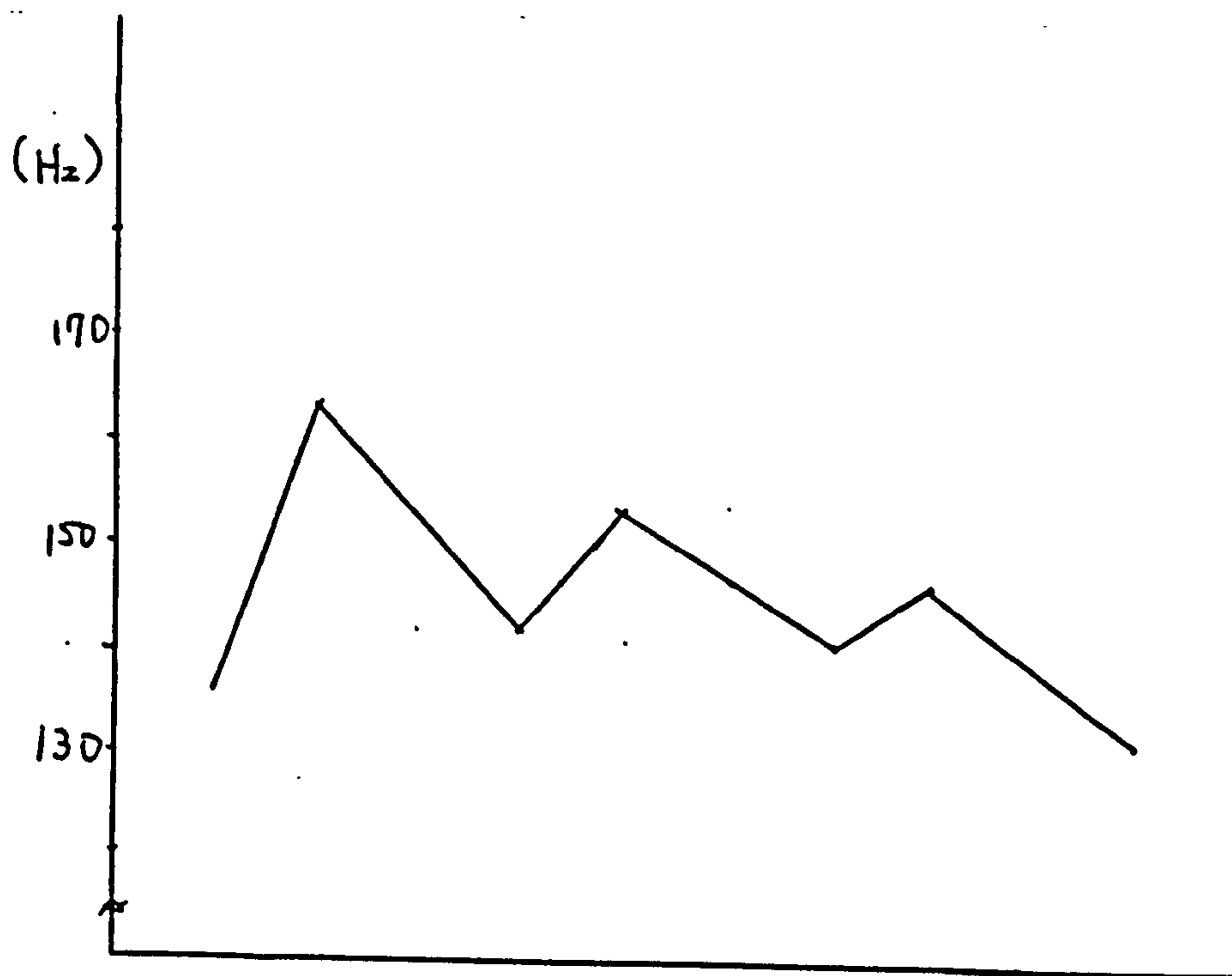


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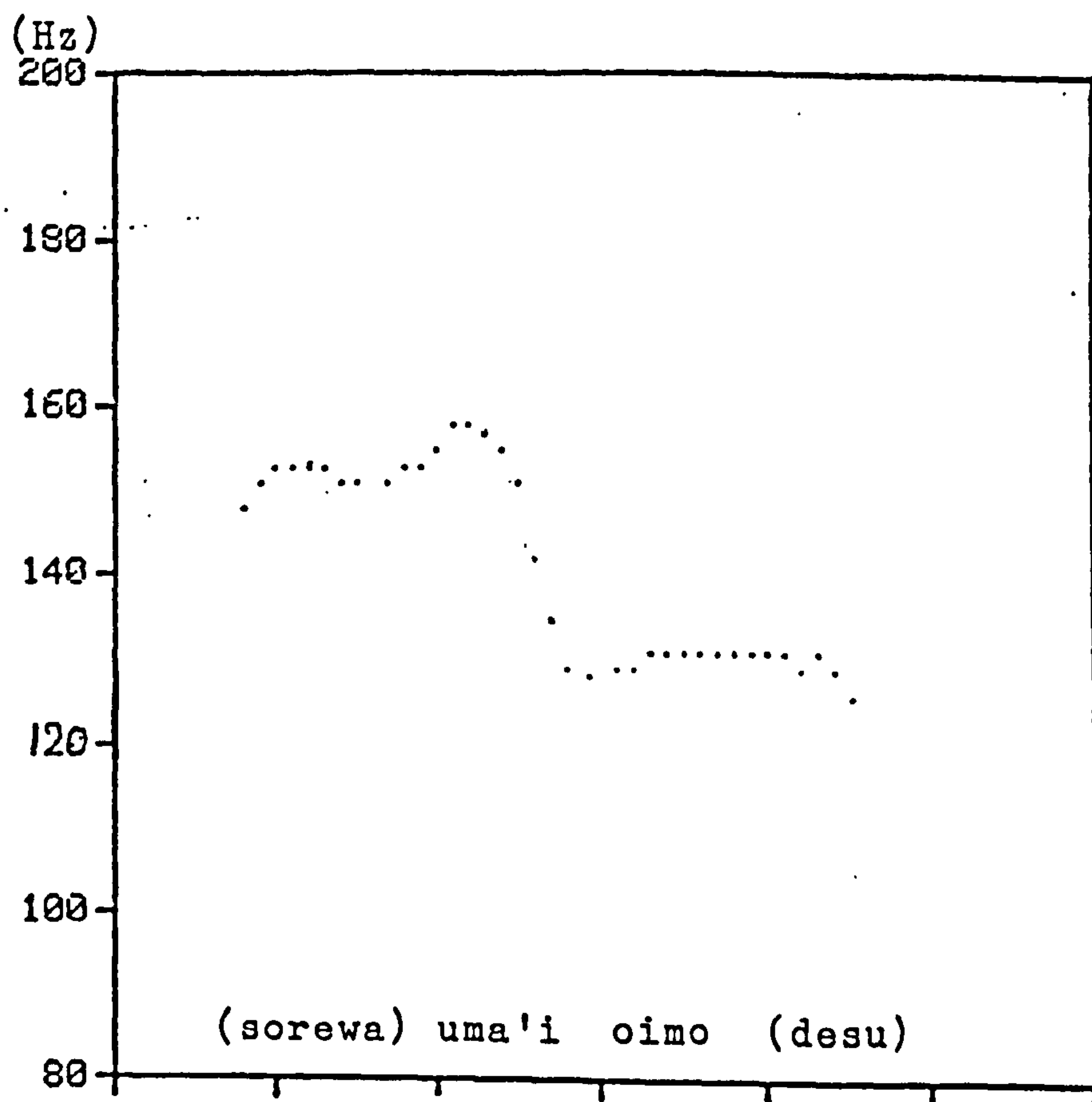


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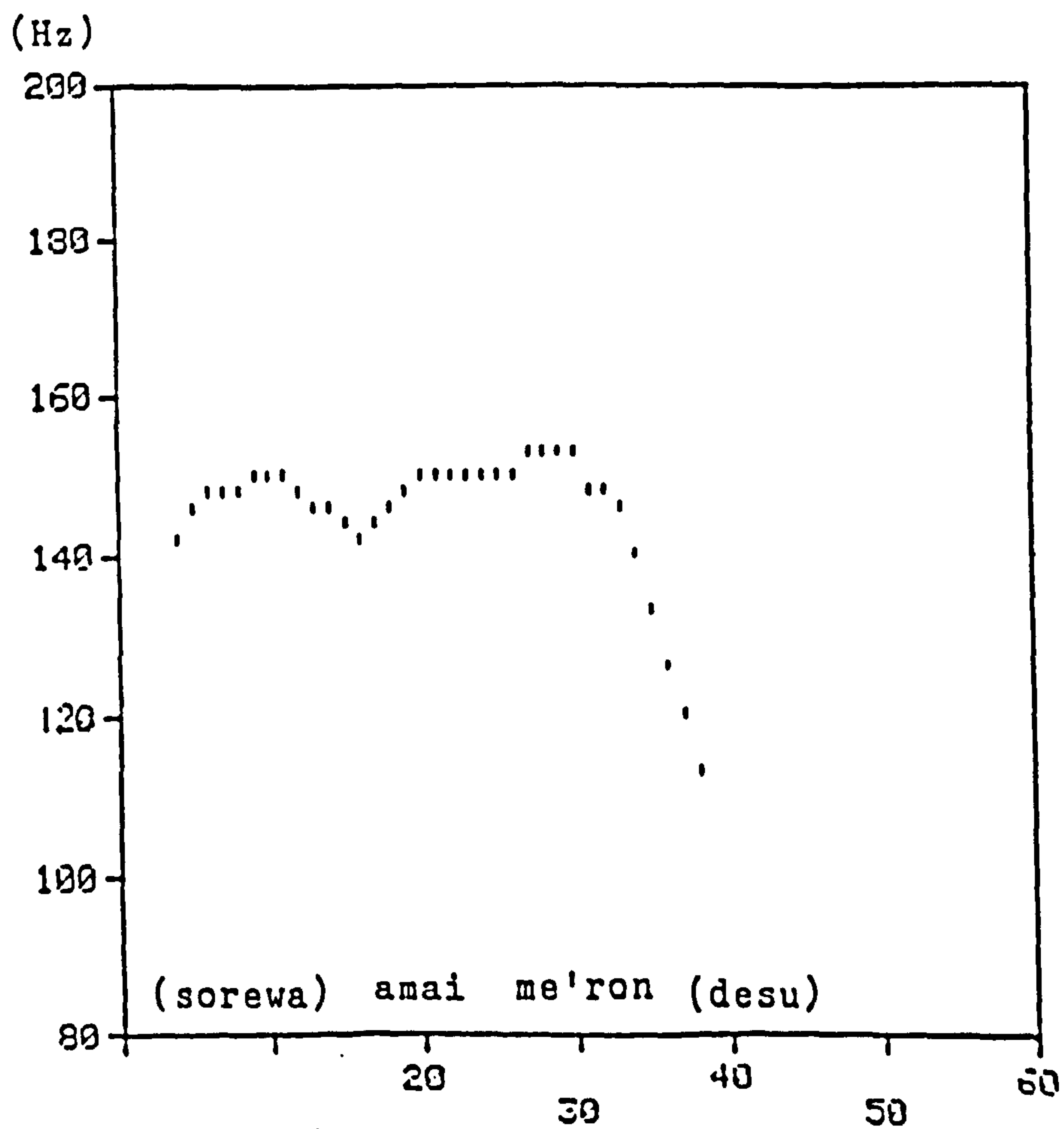


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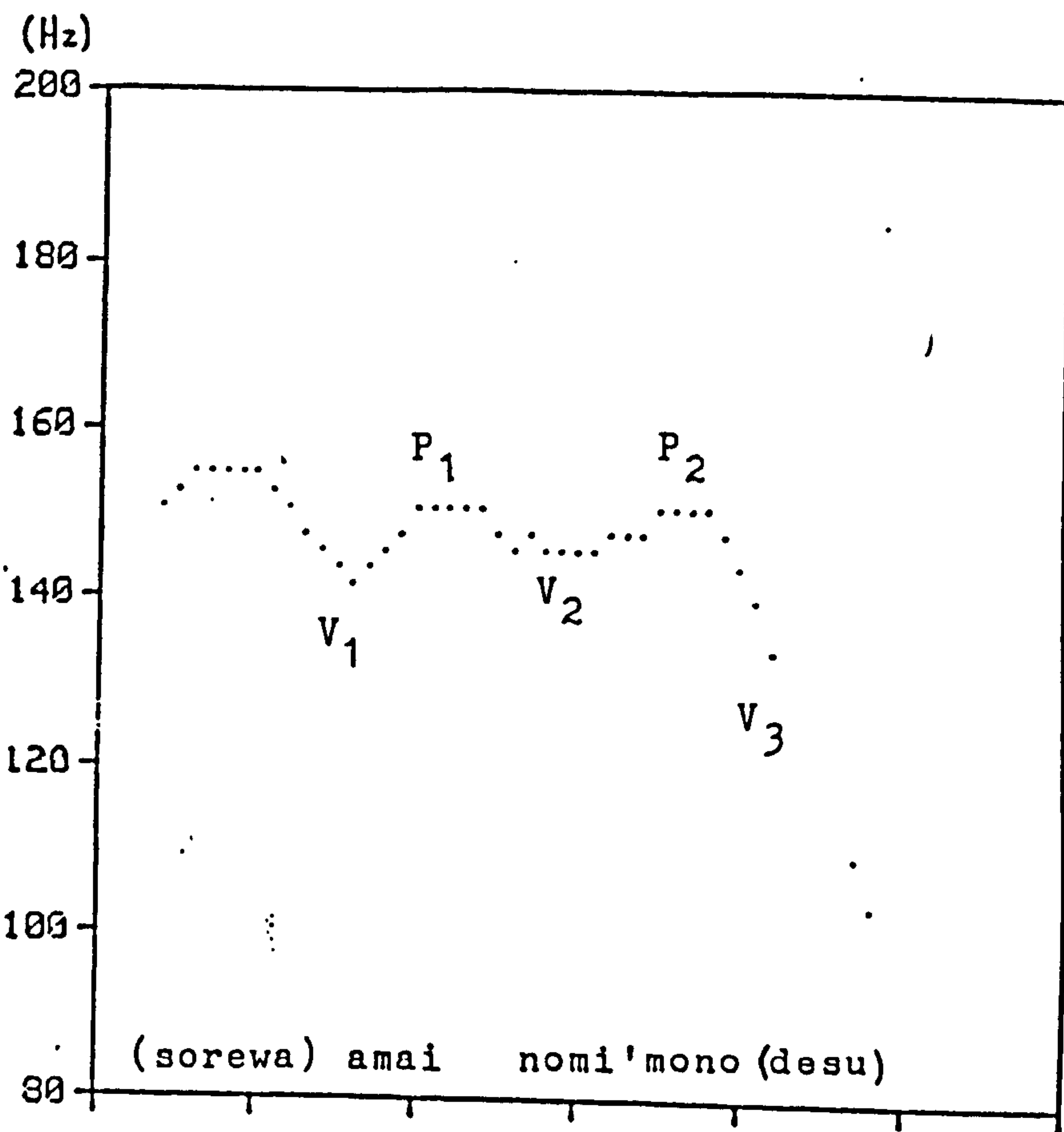


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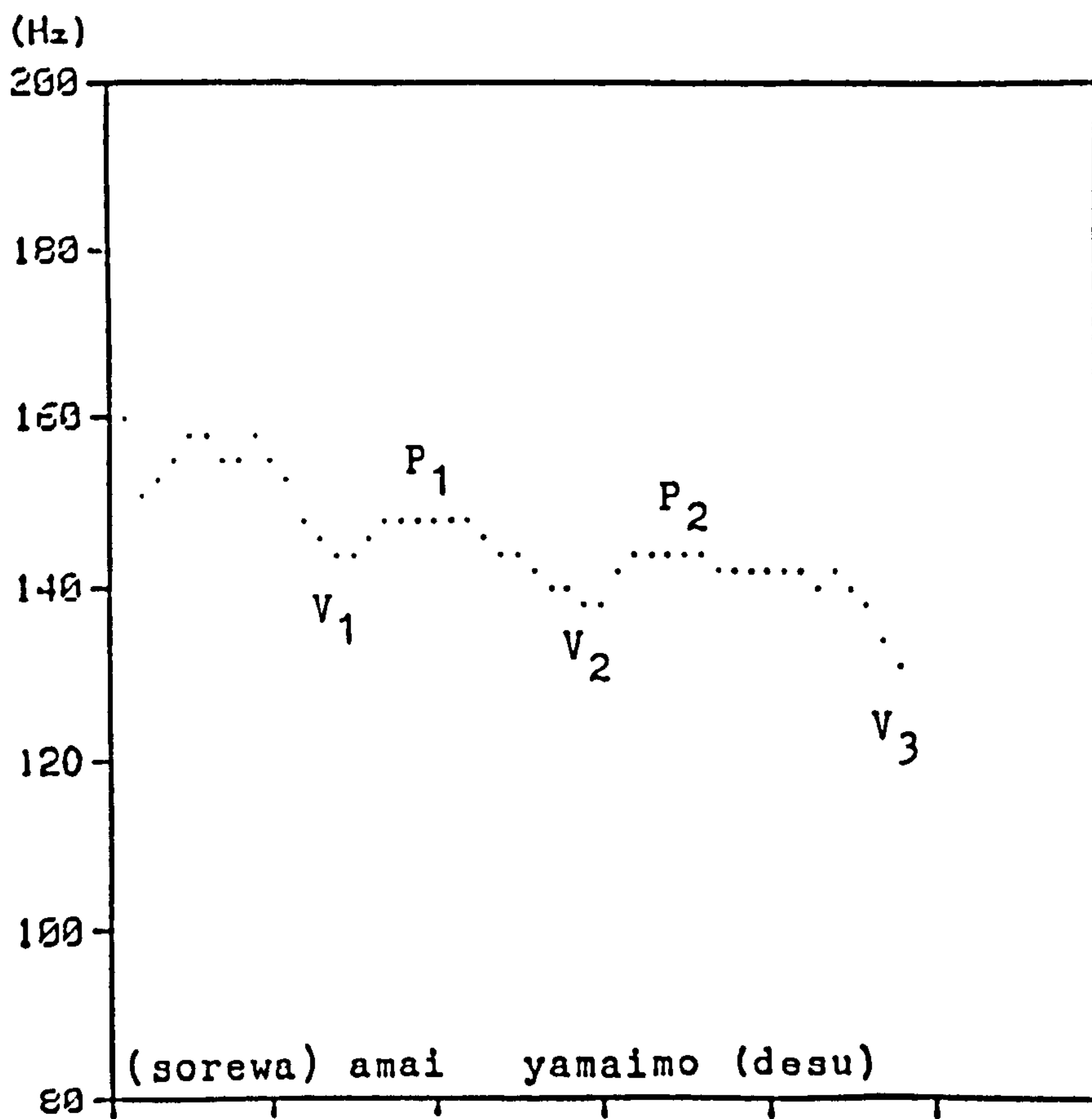


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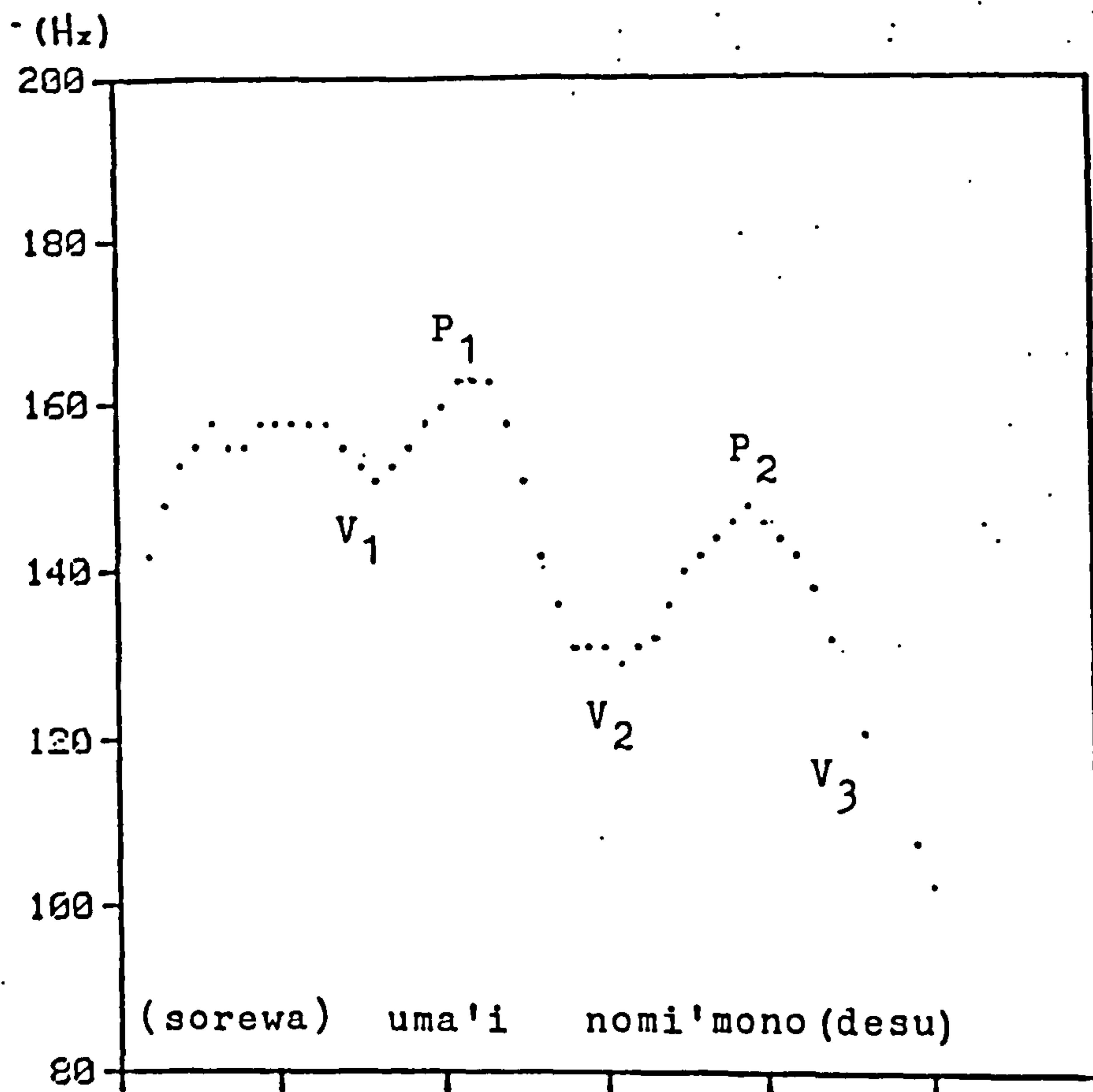


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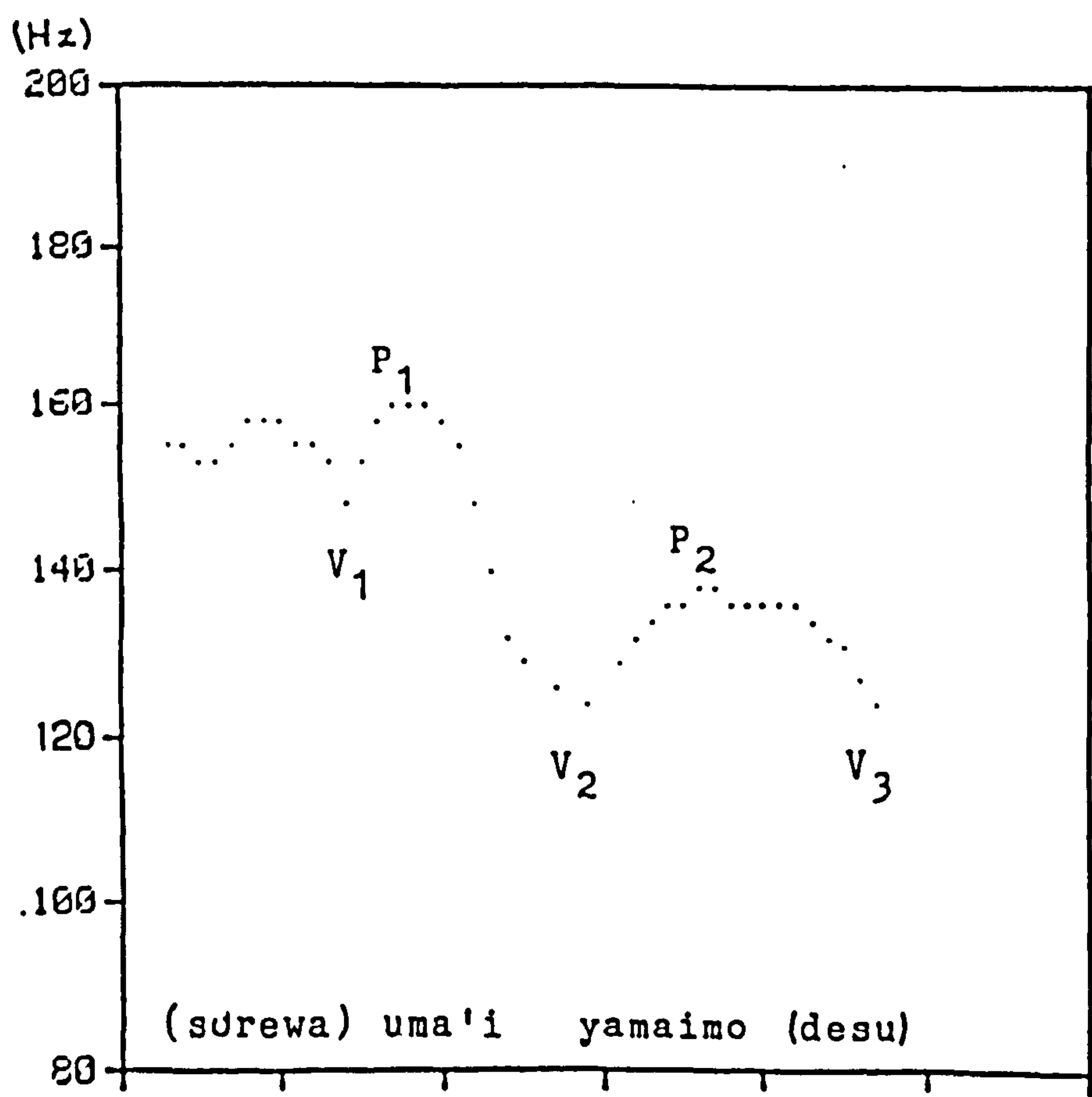


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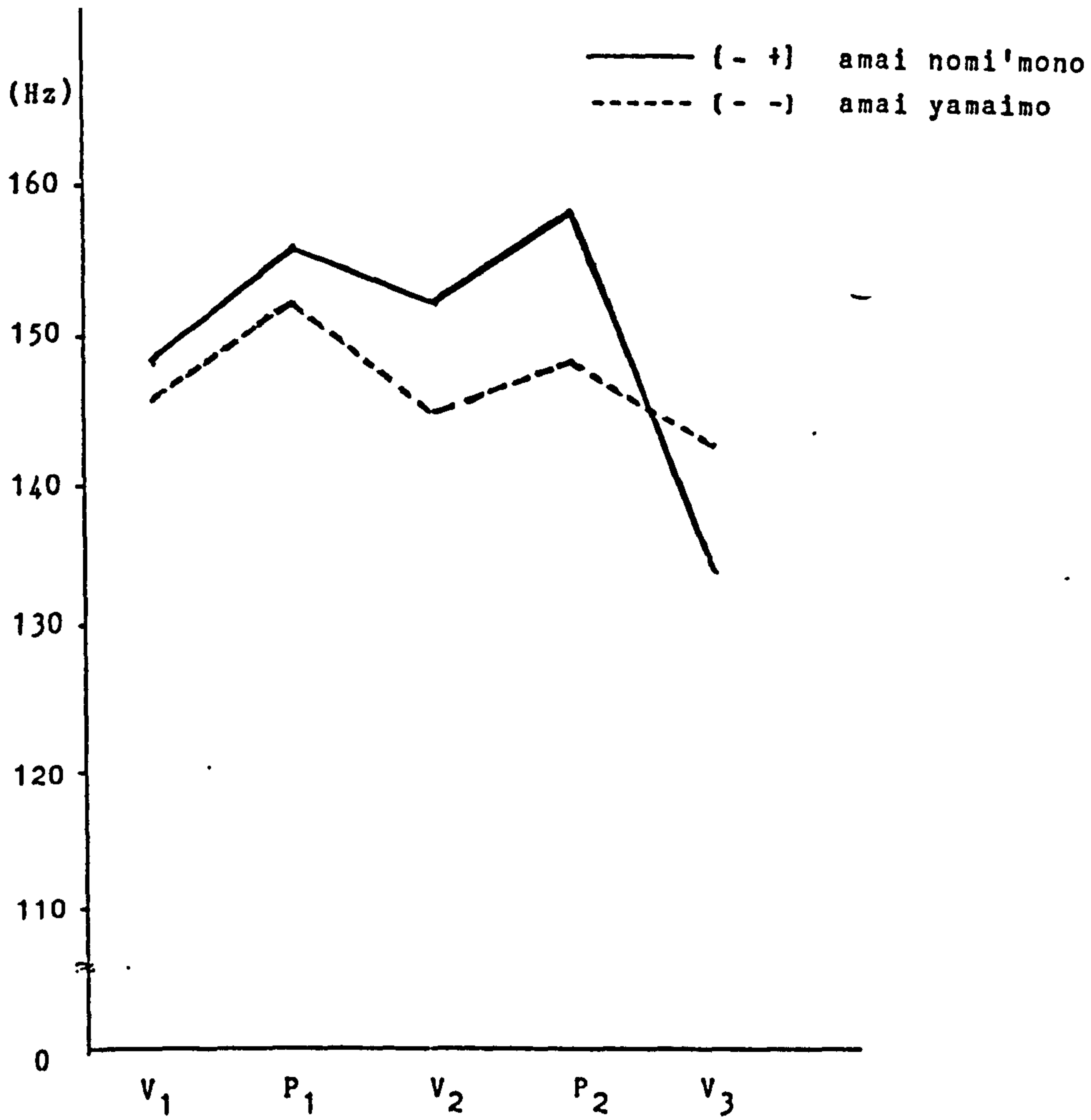


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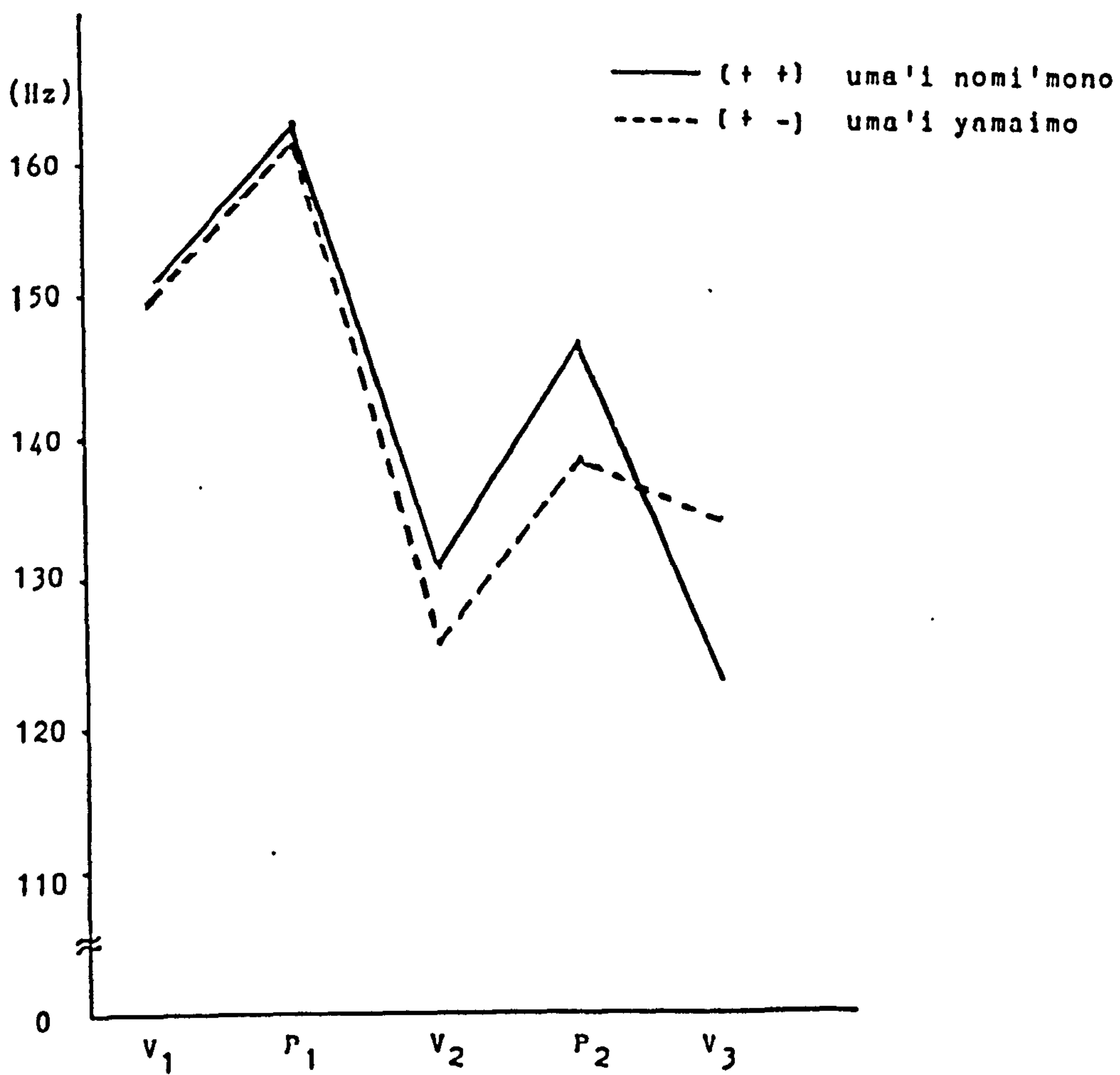


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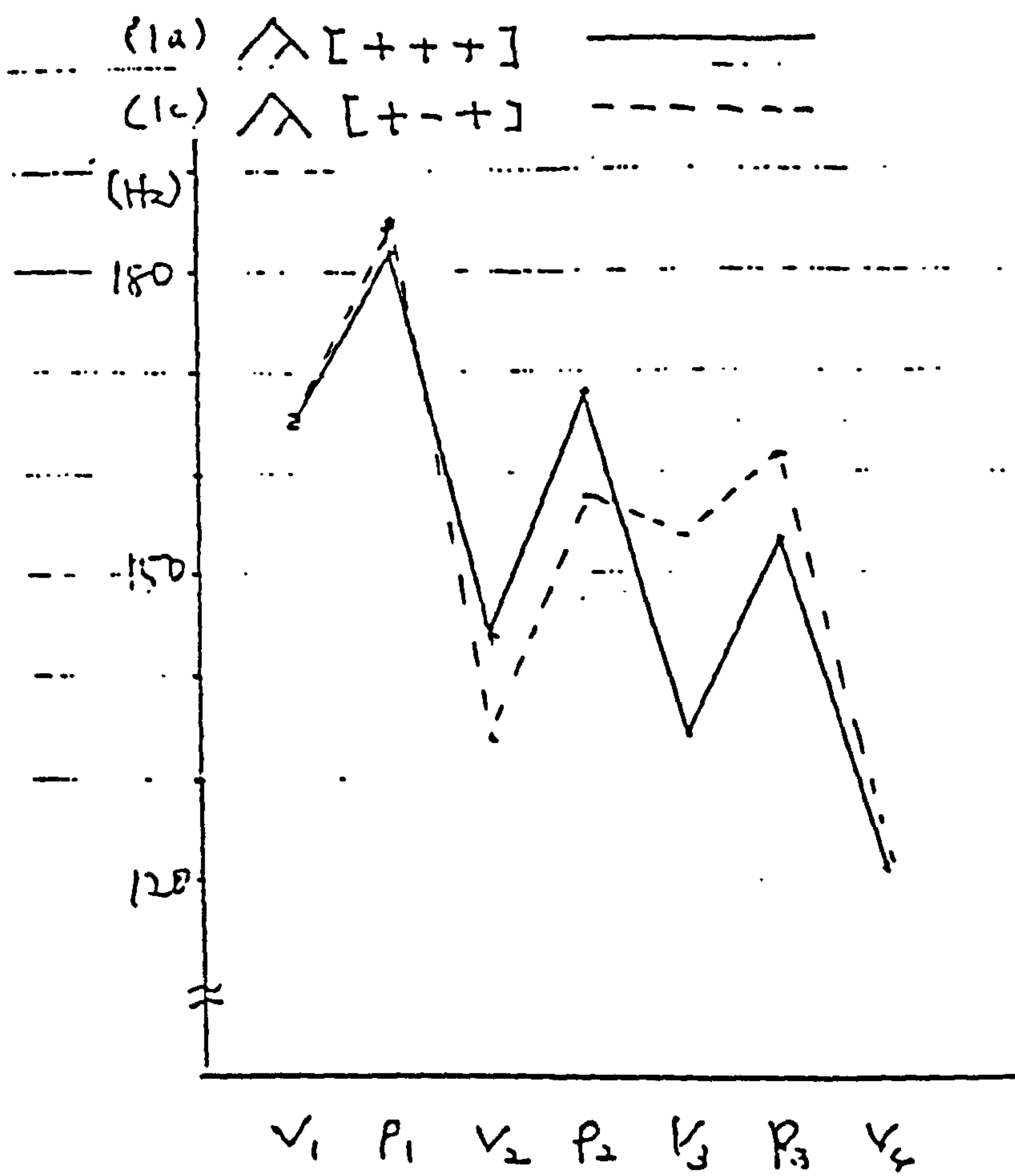


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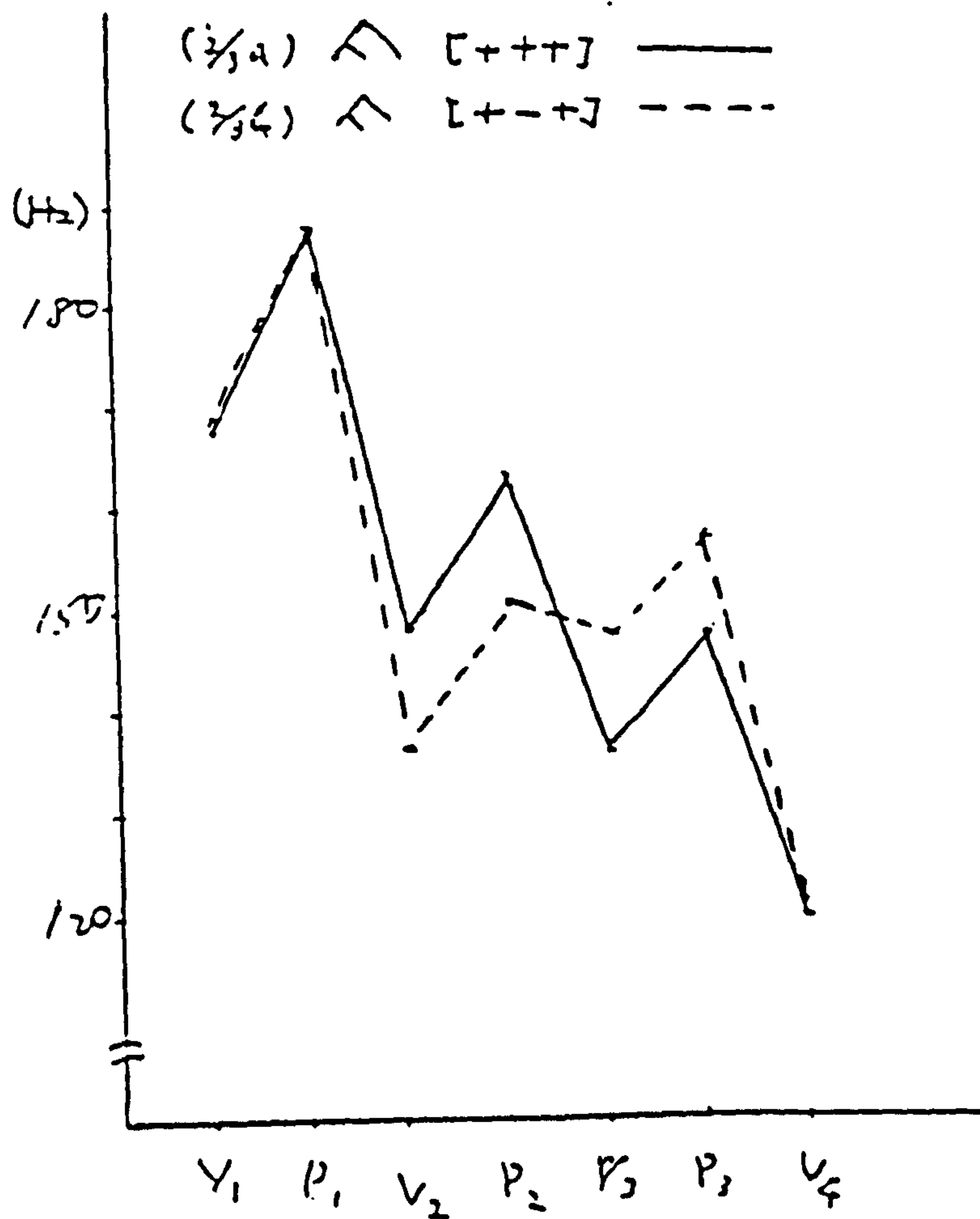


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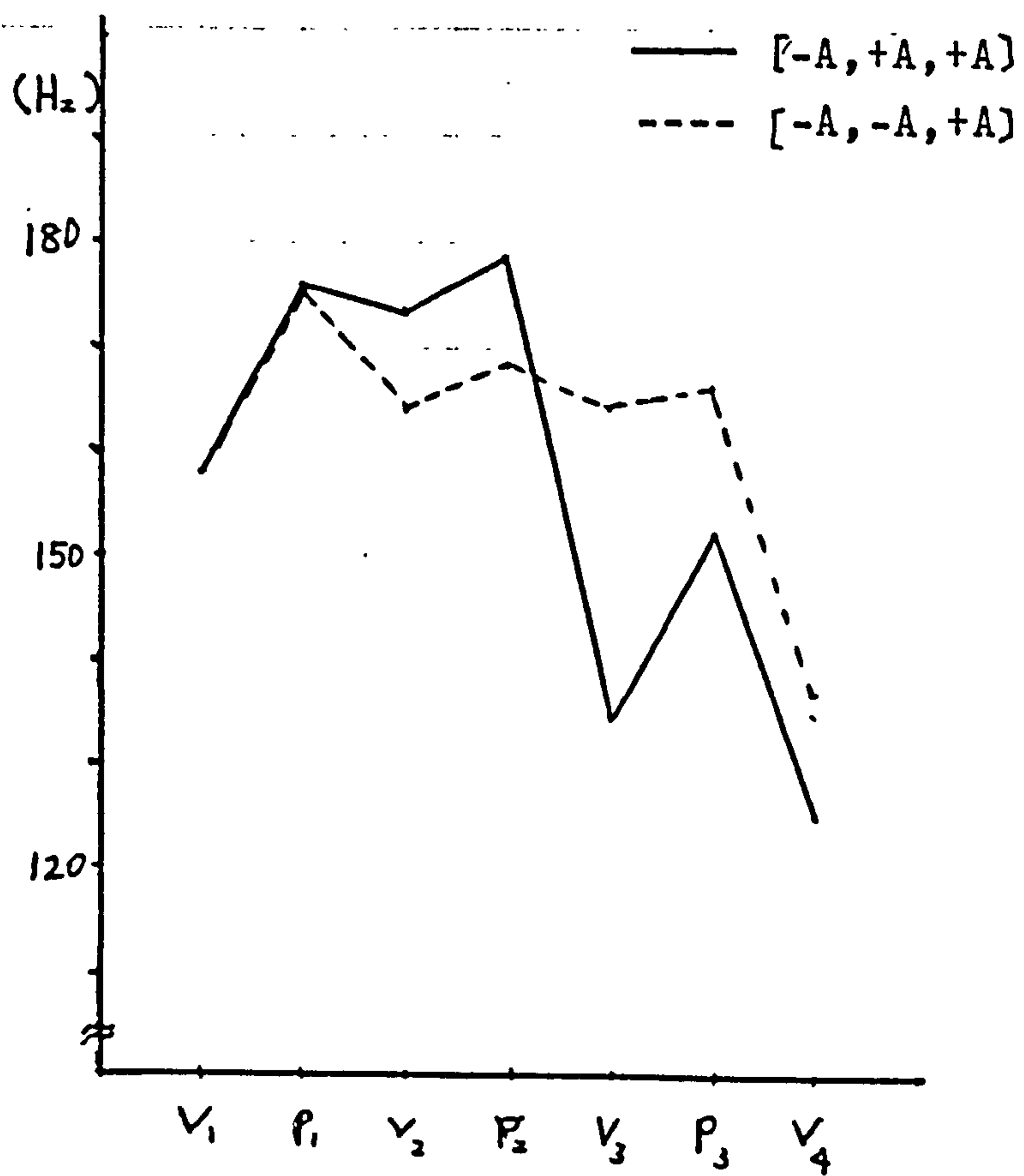


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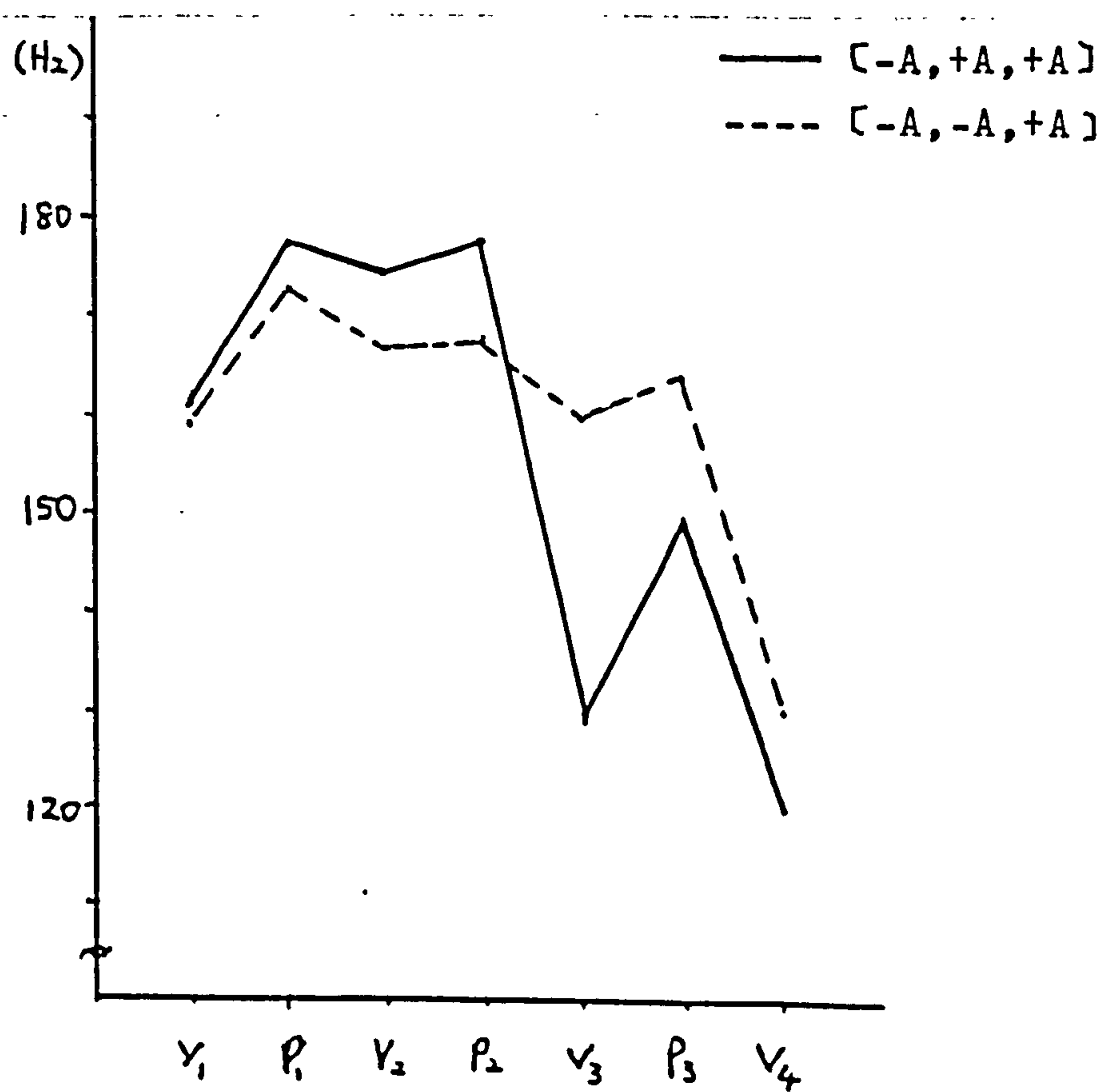




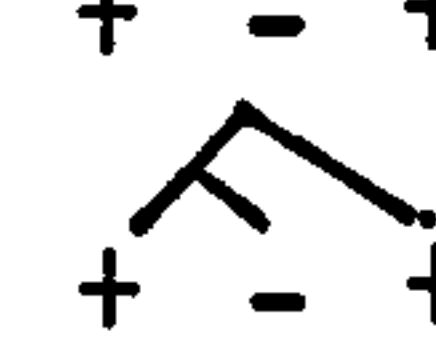
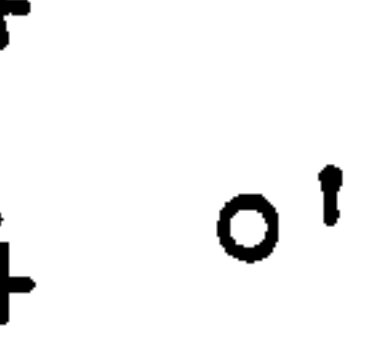


Figure 4.41




 o'okina omoi me'ron



 o'okina mimino o'okami

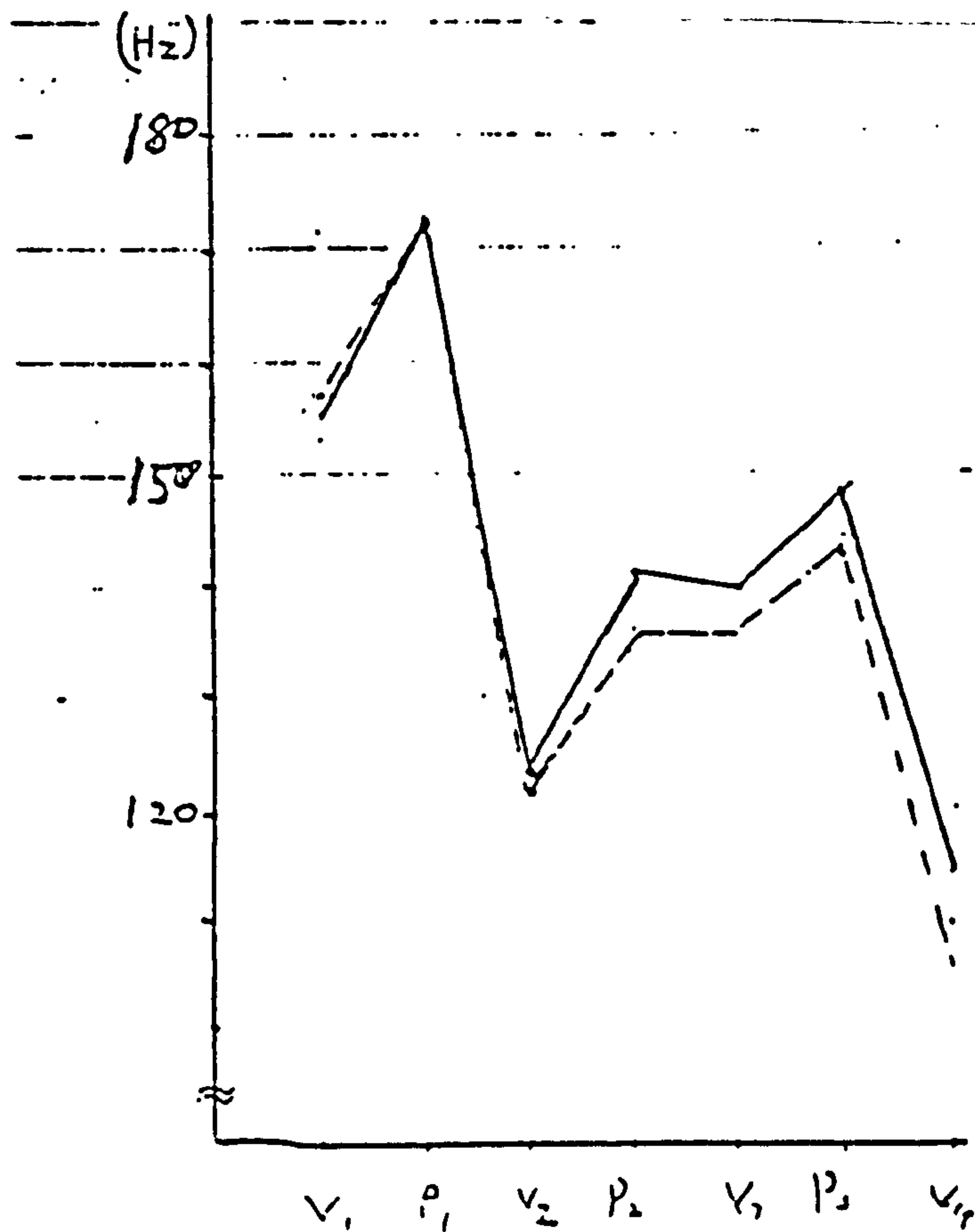


Figure 4.42

CHAPTER FIVE

DYNAMICS OF INTONATION: DOWNTREND

Having considered various problems regarding the intonational phrases and phrasing in the preceding chapter, I will now address the tendency of F0 contours to decline during the course utterances, one of the most controversial issues in the research of intonation in Japanese as well as in other languages.^{<1>} What I intend to do in this chapter is to present my own experimental evidence and propose a new view of the intonational phenomenon in Japanese. Specifically, I will show the following four points.

First, I will demonstrate that Poser (1984)'s downstep (catathesis)^{<2>} model is a largely adequate model of the downward trend in Japanese (Section 2). This means not only that the tendency of F0 contours to decline during the course of time should be defined primarily as a phonologically conditioned process, but also that Poser's phonological accounts of the trigger and effects of the process are largely justifiable by experimental evidence.

The second and most important goal of this chapter is to show that the process of Japanese downstep involves not only the tonal aspect, which Poser has successfully explored, but two other aspects as well. In Sections 3 and 4, I will show that the ups and downs of F0 contours in Japanese are heavily

constrained by the syntactic configuration of the phrase or sentence, much more so than has previously been thought ('metrical' aspect of downstep). This casts doubt on the traditional assumption that the syntactic information can be exhaustively 'encoded' onto intonational representation by way of the linear (or pseudo-hierarchical) intonational phrasing of utterances into intonational categories. Instead, I propose that the intonational structure of Japanese involves a highly hierarchical organization, reflecting the syntactic hierarchy of sentences in a more direct manner than has previously been postulated. I will employ the notion of 'metrical boost' to account for the systematic effect of syntax on the configuration of downstep, and show that this notion provides a plausible account of the intonational differences which syntactically complex phrases generally show in Japanese (sections 3.3 and 4).

As a third goal of this chapter, I will discuss the 'rhythmic' aspect of downstep in Section 5. I will claim that the downstep curves are modified by the principle of rhythmic alternation as well as by the principle of metrical boost.

And last, but not least, I will confirm another claim by Poser that F0 contours in Japanese exhibit a mechanical declination (the tendency of F0 to decline as a function of time) alongside the phonologically conditioned process of downstep (Section 6). I will show that pitch tends to decline in utterances in which downstep does not take place, although its effect on F0 contours is not as significant as the effect exerted

by the phonologically conditioned lowering process.

While showing the three major points just mentioned, I will also consider some theoretical problems in passing which relate to the main arguments I have been trying to develop in this thesis. These include (i) the relation between syntax and phonology, (ii) the rhythmic organization of Japanese prosody, and (iii) the nature of phonetic realization rules.

1. REVIEW OF PAST WORK

1.1. Overview

Before presenting my own experimental data, I will briefly review the past work on this topic. Many researchers of Japanese intonation have reported or remarked on the downward trend of pitch contours during the course of utterances: e.g. McCawley (1968); Fujisaki & Sudo (1971); Haraguchi (1977); Shimizu & Dantsuji (1981); Higurashi (1983); Poser (1984); Beckman & Pierrehumbert (1986). These studies fall into two groups according to their view of the mechanism underlying the downward trend.

Some people, including Fujisaki & Sudo (1971), Shimizu & Dantsuji (1981) and Higurashi (1983), believe that the downward trend of pitch in Japanese is a purely phonetic or mechanical phenomenon which takes place essentially as a function of time. Under this hypothesis, the declining effect is defined independently of the phonological and other linguistic structures of utterances such as their tonal and syntactic structures.

While this first group of investigators characterize the downward F0 trend as a purely phonetic phenomenon caused possibly by (pseudo-)universal physiological factors, the second group assume that the F0 trend is for the most part linguistically controlled. According to this group of investigators, which includes McCawley (1968), Poser (1983)^{<3>} and Beckman & Pierrehumbert (1986), the intonational phenomenon is triggered by a certain configuration of the phonological (accentual or tonal) structure of the utterance. Some of this latter group (e.g. McCawley) further assume that not only the cause but also the effect of the downward trend can be defined phonologically, that is, in the phonological representation of the utterance, while others (e.g. Poser) propose to define the effect of this F0 trend at the phonetic level while defining its cause at the phonological level of speech.

1.2. Fujisaki's Contour Interaction Model

While there are thus two seemingly competing interpretations as to the nature of the downward trend of F0 contours, there is comparatively little experimental work in the literature which systematically corroborates one interpretation, or successfully refutes the other. In fact, it is not an overstatement to say that there was no systematic experimental work on the downward trend in Japanese until quite recently (cf. Poser, 1984).

Fujisaki, for example, proposed his intonation model on the phonetic interpretation (e.g. Fujisaki & Sudo, 1971; Fujisaki &

Hirose, 1982), which is accepted by many Japanese linguists today (e.g. Inoue ed. 1983). However, Fujisaki himself has shown very little experimental evidence to support the phonetic hypothesis or his theoretical model constructed upon it. There are of course some phoneticians who claim to have demonstrated the mechanical nature of the downward trend, but experimental evidence they provide is either fragmentary or just incomplete.^{<4>}

Deferring the discussion of the experimental evidence for the phonetic interpretation of downward trend of pitch, I will sketch here the intonation model proposed by Fujisaki and his colleagues (e.g. Fujisaki & Sudo, 1971; Fujisaki & Hirose, 1982) which, as far as I know, is the only theoretical intonation model put forward on the phonetic interpretation. Fujisaki's intonation model, which Ladd (1983) aptly calls "contour interaction model," assumes that F0 contours of Japanese utterances can be described as an interaction of two independent contours, termed 'phrase component' and 'accent component.'^{<5>}

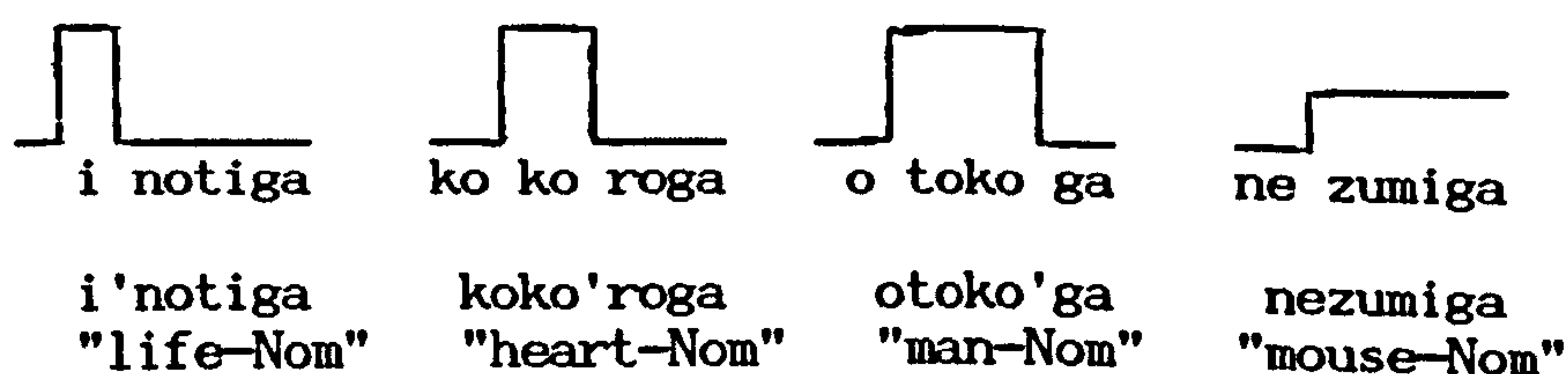
Of these two components, the phrase component embodies the tendency whereby F0 contours decline during the course of utterances. Each utterance is supposed to involve one or more phrase components which decay exponentially in the course of time. (1) illustrates the typical F0 contour which this component depicts.

(1)

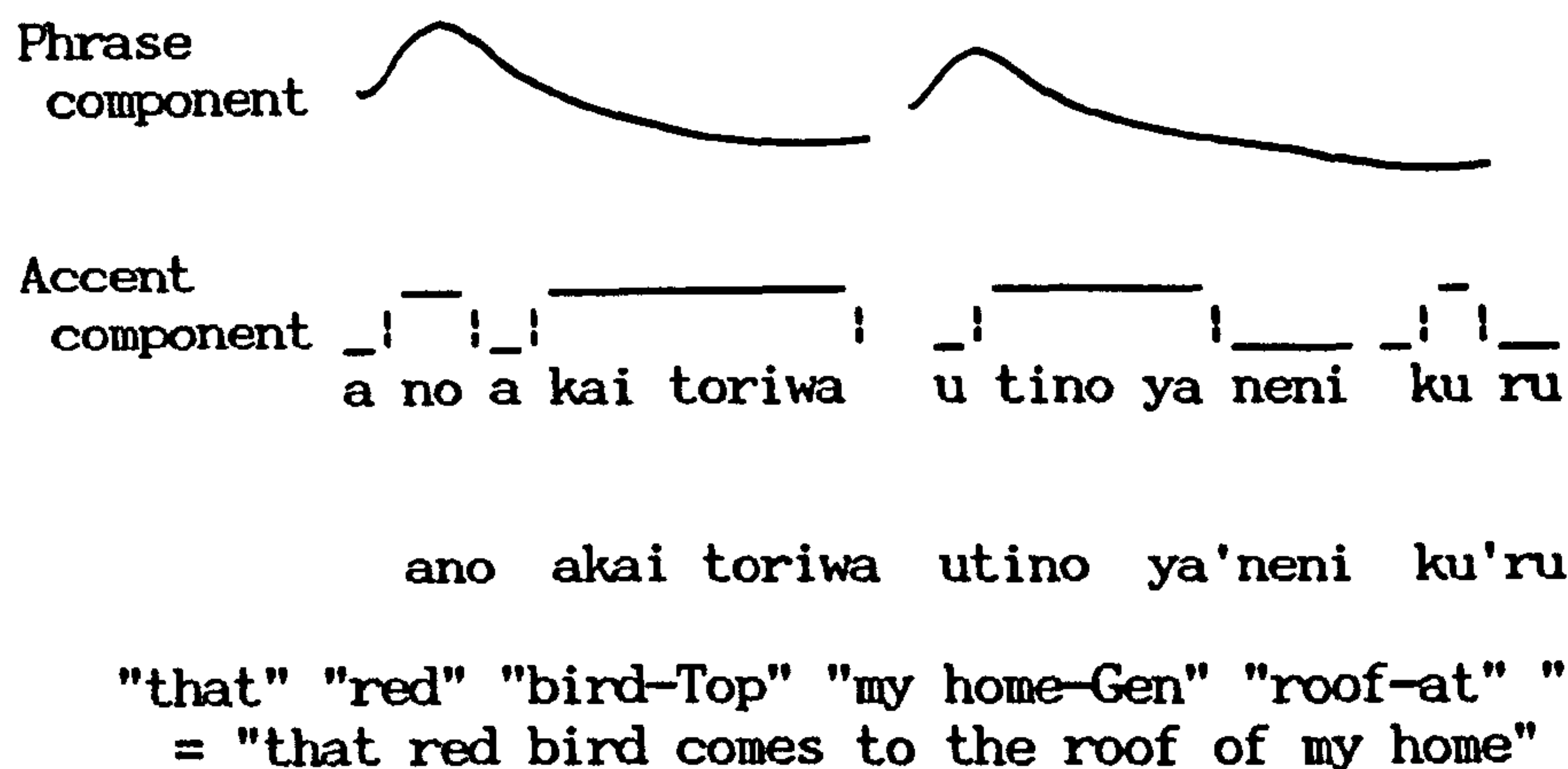


While the phrase component embodies the overall downward trend of pitch, the accent component is defined as a contour in which pitch features relating to word accent are realized. This component consists of one or more accent units (or 'accent phrases' — see Chapter 4, section 1), each of which is characterized by an initial F0 rise, which corresponds to initial lowering, and a sudden F0 drop caused by accent (i.e. accentual fall). (2) illustrates the typical F0 contours of this component. (3) illustrates, with the actual sentence Fujisaki uses (Fujisaki & Sudo, 1971:80), the way they interact with the F0 contours generated in the phrase components to yield the surface F0 contour of utterances.

(2)

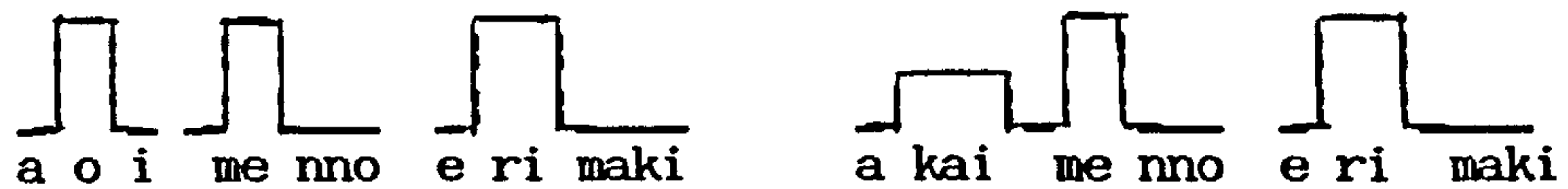


(3)



As mentioned above, Fujisaki provides little evidence to corroborate his theory.^{<6>} Viewing his model as a whole, however, it is not difficult to see some assumptions on which it is based. One such assumption is that accent units do not interact with each other, or to be more specific, the phonological structure of a given accent unit does not exert any influence on that of its neighboring accent units. Thus, an accent unit is assumed to have the same F0 features whether it follows an accented unit or an unaccented unit. (4) illustrates this point by showing how Fujisaki describes the two phrases, ao'i me'nno eri'maki "blue cotton muffler" and akai me'nno eri'maki "red cotton muffler" (Note Fujisaki assumes that ao'i is given a higher F0 than akai because of accent, i.e. accentual boost, and that MPF is generally blocked between akai and me'nno because of the branching constraint discussed in Chapter Four).

(4) Accent Component



Another point worth emphasizing about Fujisaki's model is the tacit assumption that the syntactic information of utterances can be exhaustively encoded onto intonational structure at the stage of intonational phrasing, that is, where utterances are decomposed into the two types of components. Thus, the right-branching and left-branching phrases in (5) should show essentially the same F0 shape, as illustrated in (6).^{<7>}

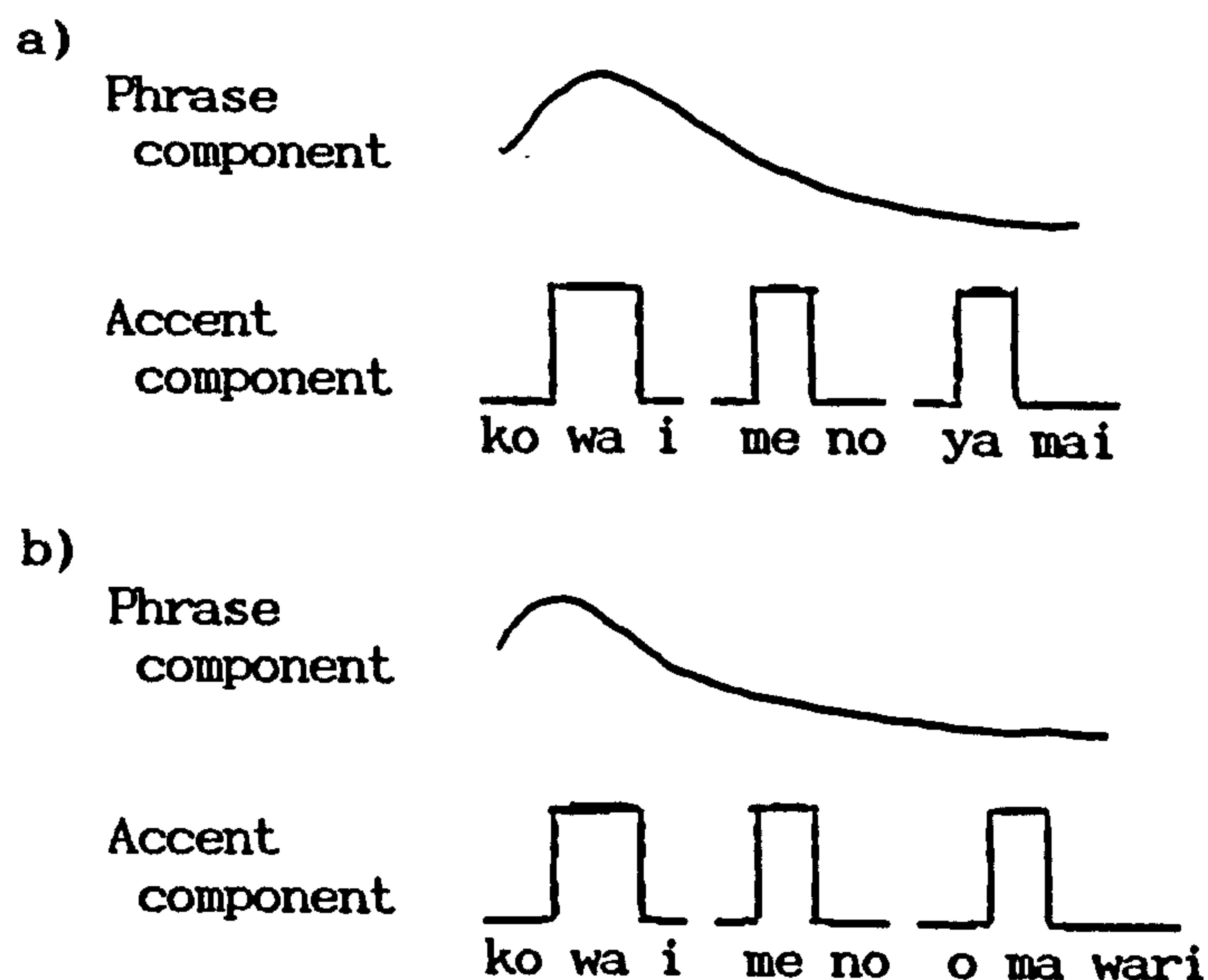
(5) a) [kowa'i [me'no ya'mai]]

"fearful" "eye-Gen" "disease"
= "fearful eye disease"

b) [[kowa'i me'no] oma'wari]

"fearful" "eye-Gen" "policeman"
= "policeman with fearful eyes"

(6)



In sections 2 and 3 below, I will show that the predictions as illustrated in (4) and (6) are false.

1.3. Phonological Interpretations of Downtrend

While the phonetic interpretation of declination describes the downward trend of pitch as a mechanical process independent of the phonological and other linguistic structures of utterances, phonology-oriented scholars tend to seek the cause of the intonational process in a certain configuration of phonological representation. I will sketch here two major models proposed along this line, McCawley's accent reduction model and Poser's downstep model. Other phonological analyses of declination are either incomplete as compared with these two models (e.g. Haraguchi, 1977)^{<8>} or significantly resemble either of these two models in the basic assumptions (e.g. Hayata, 1969; Shibatani, 1972; Beckman and Pierrehumbert, 1986).^{<9>} I will therefore consider these other analyses only in connection with the two models.

1.3.1. Accent Reduction Model

McCawley (1968) attempts to account for the downward trend of Japanese contours by two phonological rules which he terms "accent reduction rule (ARR)" and "pitch assignment rules (PARs)." Of these two types of rules, the accent reduction rule is crucially similar to the English stress assignment rules as proposed by Chomsky & Halle (1968). This rule "applies in a

cycle, first operating on smaller constituents and then on larger constituents, reducing all accents except the first each time it applies (p.173)." The effects of this rule are illustrated in (7) below where it is shown how the relative strength, as it were, of accents is determined both within and between minor phrases.

(7) a) % kabu'tte % mi'ta'ra %

"If (I) were to try putting on (a hat)"

Input to ARR: % kabu'tte % mi' ta'ra %

	1	1	1
1st cycle:		1	2
2nd cycle:	1	2	3
<hr/>			
Output	1	2	3

b) % do'o % itta'ra % i'idesuka %

"Where would it be best to go"

Input to ARR: % do'o % itta'ra % i'idesuka %

	1	1	1
1st cycle:	1	2	
2nd cycle:	1	3	2
<hr/>			
Output	1	3	2

The output of this accent reduction rule does not manifest itself as such at the phonetic output, but is modified by the effect of pitch assignment rules.^{<10>} Pitch assignment rules serve, as their name might suggest, to convert the accent representation into the strings of surface pitches. McCawley's

phonetic observations of surface pitches consist of the following three points. First, within minor phrases, it is generally the leftmost accent that is manifested at the surface. Since the leftmost accent is generally the primary accent within a minor phrase, it follows that it is the primary accent of that minor phrase that surfaces while secondary and tertiary accents are "not pronounced." Second, in the sequence of more than one minor phrase within the same major phrase, the leftmost minor phrase is realized higher in pitch than the other minor phrases with non-leftmost minor phrases showing no difference in pitch height.

On the basis of these observations, McCawley put forward the following ordered set of pitch assignment rules (p.174):

(8) Pitch Assignment Rules

- a) Everything in a minor phrase becomes high or mid pitched, depending on whether the strongest accent in the phrase is primary or non-primary.
- b) Everything after the first mora of the strongest syllable becomes low pitched.
- c) The first mora of the phrase becomes low-pitched if the second is not low-pitched.

Applying to the output of the accent reduction rule in (7). these pitch assignment rules yield the following pitch patterns. <11>

(9) a) % kabu'tte % mi' ta'ra %

Output of ARR	1	2	3
PARs (2a)	% HHH %	MMM %	
(2b)	% HLL %	MLL %	
(2c)	% LHL %	— %	

Output % LHL % MLL %

b) % do'o % itta'ra % i'idesuka %^{<12>}

Output of ARR	1	3	2
PARs (2a)	% HH %	MMMM %	MMMM %
(2b)	% HL %	MMML %	MLLLL %
(2c)	% — %	LMML %	— %

Output % HL % LMML % MLLLL %

Having seen the outline of McCawley's accent reduction theory, it will be understood that he seeks to define the cause of the downward trend of pitch in terms of the phonological structure of utterances. That is, judging from the fact that he attempts to account for the lowering phenomenon by the accent reduction rule, it is clear that he attributes the cause of the declination to the accent of minor phrases.

Given this, one may naturally wonder what happens to unaccented words and phrases of which Japanese has many. McCawley only analyzes phrases and sentences consisting of accented words and does not say anything explicitly about this question. However, since the accent reduction rule should, by definition, in no way affect unaccented words, it is clear that unaccented words do not trigger the lowering process. For the

same reason, it can be assumed that the lowering process does not apply to unaccented words.

There are three more points to note about McCawley's accent reduction model. One of them is that not only the cause but also the effect of the lowering process is defined in the phonological representation. That is, the lowering effect is described by way of the Mid pitches assigned to the relative high portion of the non-leftmost minor phrases as opposed to the High pitches assigned to the same portion of the leftmost minor phrase. Seen from a different viewpoint, this also means that it is only the relatively high-pitched portion of minor phrases that are subject to the lowering effect, and not their relatively low-pitched portion.

Another point worth emphasizing about McCawley's accent reduction model is that accent reduction takes place only between the first minor phrase and the rest. It is true that the accent reduction rule assigns different degrees of accent strength to the (accented) minor phrases within the same major phrase, but this effect is partly undone by the pitch assignment rules which subsequently apply to the output of the accent reduction rule. Thus, the second and third minor phrases in (9b) are given the same pitch height.

And lastly, it must be noted that syntactic differences are all neutralized in McCawley's accent reduction model. Since the accent reduction rule applies cyclically from a smaller

constituent to a larger constituent, the two types of branching structures, left-branching and right-branching, are supposed to yield the following difference at the output of the rule.

(10) ARR

a) Left-Branching Phrase (= (5a))

	[[[kowa'i][me'no]][oma'wari]]		
Input	1	1	1
1st cycle	1	2	
2nd cycle	1	3	2
<hr/>			
Output	1	3	2

b) Right-Branching Phrase (= (5b))

	[[ko'wai] [[me'no][ya'mai]]]		
Input	1	1	1
1st cycle		1	2
2nd cycle	1	2	3
<hr/>			
Output	1	2	3

However, at the stage where the pitch assignment rules apply to the output of the accent reduction rule, the effect of the latter rule is undone, as it were, with the the second and third minor phrases realized at the same pitch level in both of the two types of branching structures. That the two types of branching structures are thus neutralized at the output of the pitch assignment rules is illustrated in (11) below.

- (11)
a) (= (10a)) Left-Branching Phrase

% LHL % ML % LMLL %

- b) (= (10b)) Right-Branching Phrase

% LHL % ML % MLL %

All in all, McCawley's model is based on the assumption that different syntactic structures are all neutralized at the stage where the pitch assignment rules interpret the output of the accent reduction rule. This idea will be challenged in section 3.

1.3.2. Catathesis Model

While phonological interpretations of the downward F0 trend in Japanese tend to be advocated by phonologists essentially on their impressionistic observations, Poser's work (Poser, 1984) is what can be called one of experimental phonology, well balanced between phonetic verification and phonological considerations. In fact, his work is the first theoretical work that is based on ample data from instrumental experiments or, in other words, the first phonetic work well based on theoretical considerations. Although based on the speech of just one subject, his computer-aided experiments have provided fairly systematic and comprehensive data on the downward F0 trend in Japanese.

The superiority of Poser's work over most of the work

previously reported can also be found in his experimental design. He takes into account such phonological factors as the accent (accentedness) and phonological length of test phrases, and moreover, succeeds in controlling for such experimental variables as segmental effects which could otherwise affect the F0 features of utterances. In addition, he makes a sound statistical interpretation of the experimental data obtained, which had not always been done by his predecessors.

The experimental data thus obtained can be largely reproducible, as I will show in sections 2 and 6 below, and his claims on the mechanism of the downward F0 trend can accordingly be supported in most part. Poser's claims on the intonational phenomenon consist in the following four points.

First, what has been described as the downward trend of F0 contours in Japanese should not be attributed to a single mechanism but to the combination of two independent mechanisms. The primary and more important source of the downward trend is what he calls "local phonologically conditioned F0 modification (LPCFM)," or more simply "catathesis" (downstep). The second and less important source of the downward trend is what I call mechanical declination in this thesis, which he simply calls "declination."

Poser's second and third claims on the downward trend in Japanese concern downstep, the phonologically conditioned lowering process. Downstep can be defined as an effect of one part of the phonological representation in the realization of

another. To be more specific, downstep is a downward shift of pitch range triggered by accent,^{<13>} i.e. by the sequence of High-Low tones in accented words and phrases. This Poser verifies by demonstrating that minor phrases are realized at a significantly lower F0 level when they follow an accented phrase than when they follow an unaccented phrase. Thus, the peaks of nomi'mono "drink" and mirin "sweet sake" are significantly lower when following the accented word uma'i "tasty" than when they follow amai "sweet". Table 1 gives the actual F0 values and statistical results Poser reports (pp. 280;284-5).

Table 1 Summary of Data & Statistics
Peak F0 values (All 16 df)

Phrase Pair	Mean (Hz)	T	P
uma'i nomi'mono	143.1	6.63	<.0001
amai nomi'mono	157.0		
uma'i mirin	122.7	18.14	<.0001
amai mirin	151.2		

Since downstep is a shift of pitch range, minor phrases are subject to lowering not just in their relatively high-pitched portion but in their low-pitched portion as well. Poser corroborates this by demonstrating that the Low tone of an accented nonsense word is lower in pitch when preceded by an accented nonsense word than when preceded by an unaccented nonsense word.

A third claim Poser makes concerns the 'chaining' of downstep. He compared the peak F0 value of the word nomi'mono

"drink" in the phrase nuru'i uma'i nomi'mono "lukewarm tasty drink" with that of the same word which appeared in nuru'i amai nomi'mono "lukewarm sweet drink." The result was that the same word showed a significantly lower pitch peak in the former context than in the latter, that is, when following the sequence of two accented words than when following the sequence of an accented and unaccented word (Table 2). On the basis of this result and other similar results obtained from experiments in which nonsense words were used, Poser concludes that downstep 'chains,' or applies iteratively so long as its structural description is met within the same major (intonational) phrase.

Table 2 Summary of Data & Statistics
Peak F0 value (df=16)

Phrase Pair	Mean (Hz)	T	P
nuru'i uma'i nomi'mono	144.1	2.38	<.02
nuru'i amai nomi'mono	138.8		

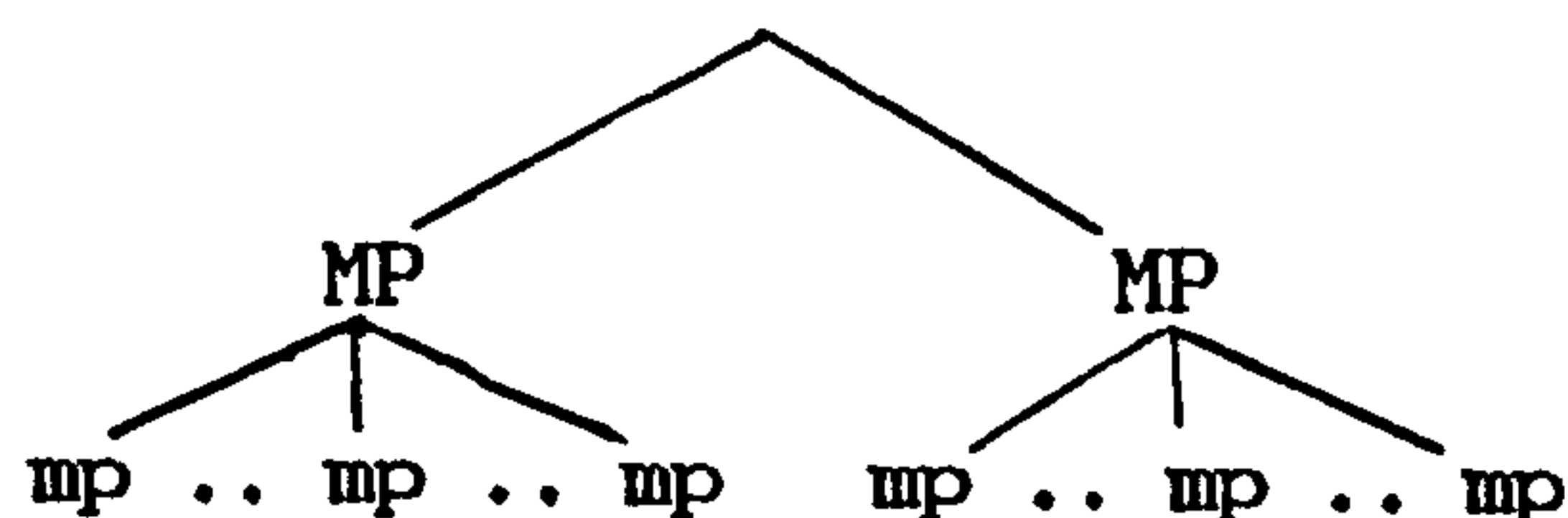
While Poser attributes the downward trend of F0 contours to the phonologically conditioned downward shift of pitch range in most part, he further claims that Japanese involves a mechanical declination as well. He makes this claim on the basis of the observation that F0 descends even in the sequences of unaccented words in which downstep does not, by definition, apply. Although the rate of F0 descending is not as great as in downstep, he found that the peaks of the minor phrases decline substantially as the utterance progresses, as illustrated in (12).

(12)



Poser's experimental results on the downward trend of pitch in Japanese (on downstep and declination) have been shown to be reproducible by Pierrehumbert and Beckman's experiments (Pierrehumbert & Beckman, forthcoming) in which more than one subject was involved.^{<14>} Although the validity of Poser's claims has also been shown by the evidence from my own experiments, his work on downstep (and the work by Pierrehumbert and Beckman (forthcoming) as well) cannot be said to be complete. The major reason for this is that he does not consider the possibility that differences in syntactic structures of utterances might cause certain effects on the configuration of downstep. In fact, he apparently puts this possibility beyond the scope of his research and analyzes phrases whose syntactic structures are not varied in a systematic fashion.^{<15>} To put this point more critically, he falsely assumes that differences in syntactic structure are exhaustively reflected on the pseudo-hierarchical representation of intonational phrasing, as illustrated in (13) below ('MP' and 'mp' stand for a major and minor intonational phrase respectively):

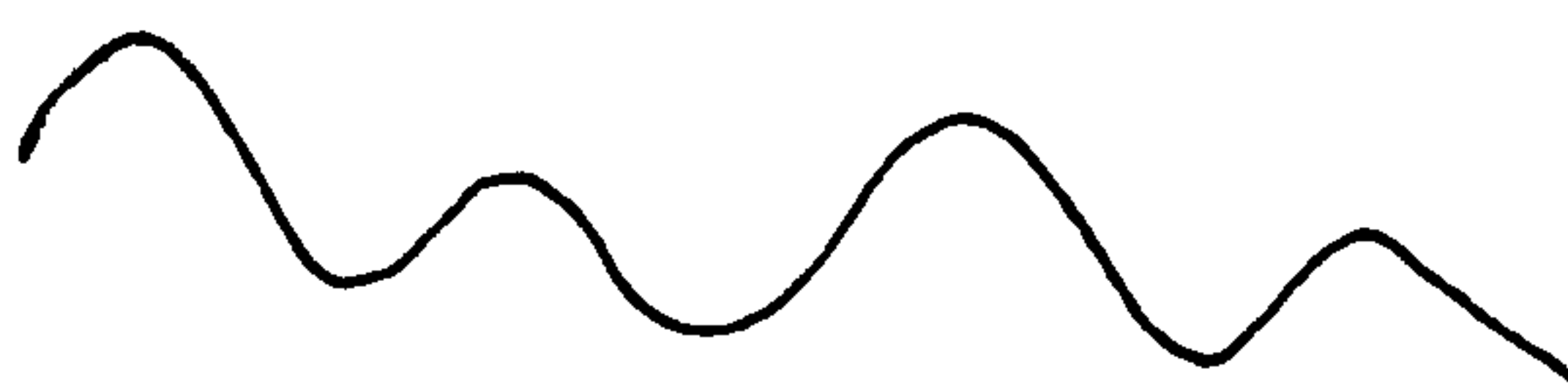
(13)



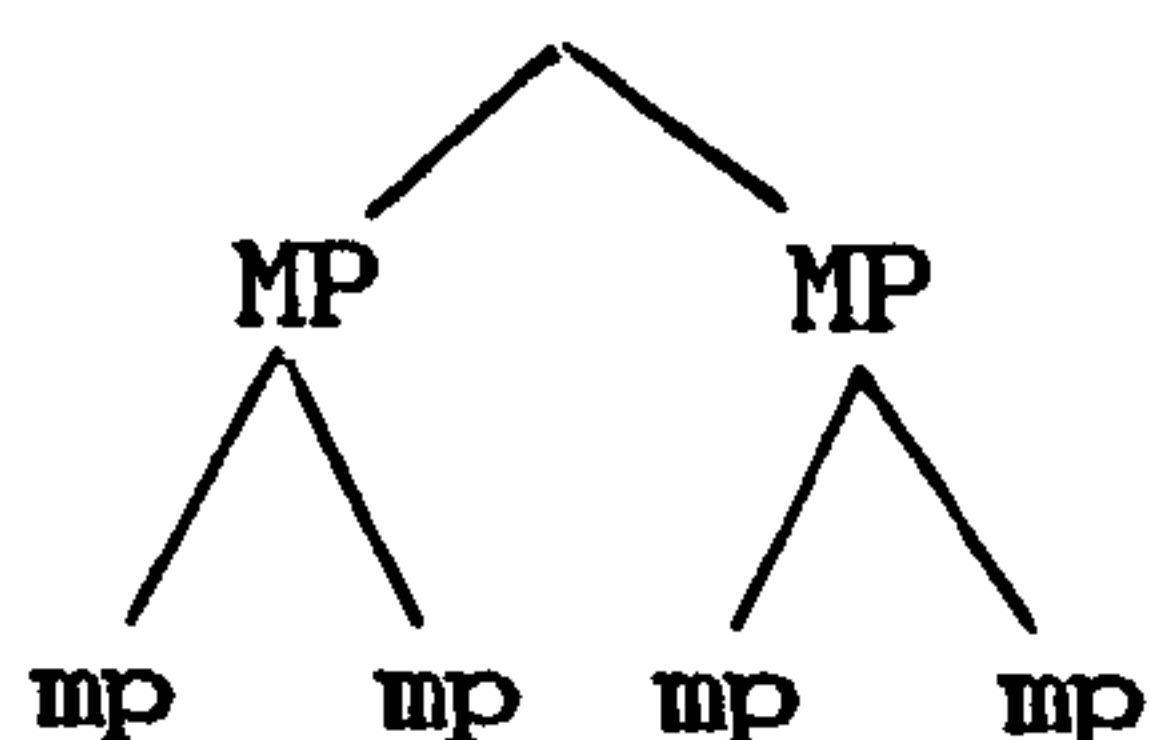
As I show in section 3 below, the configuration of downstep (and the configuration of F0 contours in Japanese in general, for that matter) varies in a systematic way depending on the syntactic structure of the utterances, and this understanding is the key to the correct and full understanding of the F0 contours which syntactically complex phrases and sentences show in Japanese.

Another point in which Poser fails in the treatment of downstep is in his approach to identifying the occurrence of downstep on the basis of the F0 contours that surface at the phonetic output.^{<16>} Given the F0 contours as in (14) below, for instance, he judges a priori that downstep has not applied between the second and third minor phrases, which he assigns to different major phrases (cf. (15)).

(14)



(15)



This analysis may seem to be justifiable in view of the fact that the third minor phrase in (14) is apparently higher in pitch than the second minor phrase. As I suggested in Chapter Four, however, this assumption is wrong since downstep as defined by Poser can have applied between the two minor phrases. That is,

as I shall show in section 4, the third minor phrase in the long phrase in (16a), ao'i, is realized at a significantly lower F0 level than the same word in (16b), which differs from (16a) in the accentedness of the second word (cf. Dataset X; Figures 5.48 and 5.52).

(16) a) na'okono a'nino ao'i eri'maki

"Naoko-Gen" "brother-Gen" "blue" "muffler"
= "Naoko's brother's blue muffler"

b) na'okono aneno ao'i eri'maki

"Naoko-Gen" "sister-Gen" "blue" "muffler"
= "Naoko's sister's blue muffler"

That a given minor phrase is realized significantly lower in pitch when following an accented minor phrase than when following an unaccented phrase is precisely what Poser calls 'catathesis' (downstep) and nothing else, and this gives rise to a paradoxical situation in which a given minor phrase has undergone downstep owing to the accent of its immediately preceding minor phrase but is somehow realized higher than the minor phrase which has triggered the lowering process. Paradoxical situations of this sort can be accounted for only if we consider the effects of syntactic structures on the configuration of downstep and on F0 contours in Japanese in general. This point will be discussed in full depth in section 4 below.

2. TONAL ASPECT OF DOWNSTEP

In the preceding section I sketched the phonetic and phonological interpretations of downtrend, the two seemingly competing hypotheses on the tendency of F0 slope to decline during the course of utterances, as well as several different models proposed on them. With these different hypotheses and models in mind, I conducted a series of experiments (Datasets IV-X) on the intonational phenomenon. The results of these experiments have shown that downtrend in Japanese involves both of the two mechanisms, one which is conditioned by phonological factors and the other which is attributable purely to phonetic or mechanic factors. In what follows, I will call the two mechanisms 'downstep' and 'mechanical declination' while using 'downtrend' as a neutral, generic term.

To begin with, I will consider the experimental data in regard to the tonal aspect of downstep. I will first show that Poser's claims on the relation between accent (tone) and downstep are largely justifiable (section 2.1). I will then discuss the interaction between accent location and downstep with a view to exploring the extent to which the phonologically conditioned process is affected by the differences in the accent location and phonological length of the phrases concerned (section 2.2).

2.1. Accent and Downstep

Poser's claims on downstep can be summarized in the following three points.

- (i) Downstep is triggered by accent. That is, the rate of F0 declination is significantly greater when following accented phrases than when following unaccented phrases.
- (ii) Downstep is a register shift whereby a whole minor phrase following an accented phrase is lowered. That is, not only the relatively high portion (peak) of the following minor phrase but also its low portion (valley) undergoes downstep. Similarly, downstep affects not only accented minor phrases but unaccented phrases as well.
- (iii) Downstep chains in the sense that every accented phrase lowers the following phrase irrespective of its position in the phrase or of how many accented words there are.

2.1.1. Trigger and Effect of Downstep

2.1.1.1.

Datasets V and VI contain the pairs of phrases given in (17). The two members of these pairs differ in the accentedness of the first component phrase, with the second phrase accented in both cases. (Again, [+A] and [-A] denote an accented and unaccented phrase respectively):

(17)

- a) [+A,+A] uma'i me'ron 'tasty melon'
[-A,+A] amai me'ron 'sweet melon'
- b) [+A,+A] uma'i nomi'mono 'tasty drink'
[-A,+A] amai nomi'mono 'sweet drink'
- c) [+A,+A] na'okono o'obaa 'Naoko's overcoat'
[-A,+A] naomino o'obaa 'Naomi's overcoat'
- d) [+A,+A] na'okono eri'maki 'Naoko's muffler'
[-A,+A] naomino eri'maki 'Naomi's muffler'

The two types of phrases in (17) exhibit F0 contours as illustrated in Figures 5.1-5.2. The differences they show are illustrated in Figure 5.3, where the time-normalized schematic F0 contours of the pair in (17b) are illustrated on the basis of the averaged peak and valley values.

The first minor phrase ([Valley1] and [Peak1]) show a higher F0 value in the sequences consisting of two accented component phrases than in those made up of an unaccented phrase plus an accented phrase. These differences are due to the effect of accentual boost discussed in Chapter Three (section 2).

While accented elements are thus given higher F0 than unaccented elements in the phrase-initial position, accented elements are realized at a lower F0 level when they follow an accented element than when they follow an unaccented element. That is, the three parameters representing the onset, peak and terminal of second elements — [V(alley)2], [P(eak)2] and [V(alley)3] respectively — all show lower F0 values when following an accented phrase than when following an unaccented phrase. These differences are statistically significant as shown in Tables 3-5. <17>

Table 3 Effect of Accent on [Valley2]: (all 20 df)

Pair	Accent	Mean	SD	t	P
(17a)	[+A,+A]	132.1	3.96	10.870	<.001
	[-A,+A]	149.6	3.59		
(17b)	[+A,+A]	130.5	3.59	15.662	<.001
	[-A,+A]	151.8	2.71		
(17c)	[+A,+A]	123.3	4.61	17.292	<.001
	[-A,+A]	156.5	4.37		
(17d)	[+A,+A]	124.1	4.16	21.419	<.001
	[-A,+A]	155.8	2.64		

Table 4 Effect of Accent on [Peak2]: (All 20df)

Pair	Accent	Mean	SD	t	P
(17a)	[+A,+A]	141.5	4.39	6.391	<.001
	[-A,+A]	152.3	3.50		
(17b)	[+A,+A]	146.5	4.41	6.785	<.001
	[-A,+A]	158.1	3.56		
(17c)	[+A,+A]	145.3	5.02	7.231	<.001
	[-A,+A]	159.4	4.06		
(17d)	[+A,+A]	143.0	3.79	10.542	<.001
	[-A,+A]	160.5	3.96		

Table 5 Effects of Accent on [Valley3]: (All 20 df)

Pair	Accent	Mean	SD	t	P
(17a)	[+A,+A]	108.1	4.66	2.135	<.05
	[-A,+A]	112.2	4.33		
(17b)	[+A,+A]	122.7	5.22	5.073	<.001
	[-A,+A]	133.1	4.35		
(17c)	[+A,+A]	107.2	3.09	2.826	<.02
	[-A,+A]	111.1	3.36		
(17d)	[+A,+A]	122.3	3.35	6.494	<.001
	[-A,+A]	133.6	4.70		

The results in Tables 3-5 confirm Poser's claim that the accent in first elements exerts a lowering effect on the following elements. In descriptive terms, this lowering effect is attributable to the combination of two F0 changes, the big F0 drop induced by accent (accentual fall) and a relatively small F0 rise at the onset of the next phrase. This point is shown clearly by the statistical results in Tables 6-9. Table 6 demonstrates with the pair in (17b) that the F0 drop over the two component phrases (i.e. [Peak1-Valley2]) is greater when the first component is accented than when it is unaccented. Table 7 shows with the same pair that the F0 rise at the onset of the second component phrase is greater when following an accented phrase than when following an unaccented phrase. However, since the extent of the F0 drop ([Peak1-Valley2]) is much greater than that of the following F0 rise ([Peak2-Valley2]) in the sequence of two accented phrases as compared with the sequence of an unaccented phrase plus an accented phrase, the overall downward shift occurs in the former sequence, but not in the latter (cf. Tables 8-9).

Table 6 F0 Fall: [Peak1-Valley2] (df=20)

Accent type	Mean	SD	t	P
(17b) [+A,+A]	31.73	3.61	22.764	<.001
[-A,+A]	3.73	1.92		

Table 7 Initial Lowering: [Peak2-Valley2] (df=20)

Accent type	Mean	SD	t	P
(17b) [+A,+A]	15.91	3.24	7.088	<.001
[-A,+A]	6.27	3.13		

Table 8 Inter~Peak Difference: [Peak1~Peak2]
(df=20)

Accent type	Mean	SD	t	P
(17b) [+A,+A]	15.80	3.76	13.297	<.001
[-A,+A]	-2.55	2.58		

Table 9 Inter~Valley Difference: [Valley1~Valley2]
(df=20)

Accent type	Mean	SD	t	P
(17b) [+A,+A]	20.10	3.81	16.588	<.001
[-A,+A]	-4.45	3.11		

2.1.1.2.

Downstep affects not only accented phrases but also unaccented phrases, as correctly claimed by Poser. Datasets V and VI contain three pairs of phrases to show this.

(18)

- a) [+A,-A] uma'i oimo 'tasty potato'
- [-A,-A] amai oimo 'sweet potato'
- b) [+A,-A] uma'i yamaimo 'tasty yam'
- [-A,-A] amai yamaimo 'sweet yam'
- c) [+A,-A] na'okono omamori 'Naoko's amulet'
- [-A,-A] naomino omamori 'Naomi's amulet'

The two types of phrases in (18) show F0 contours as illustrated in Figures 5.4 and 5.5. The differences in the F0 contours they exhibit are schematized in Figure 5.6. Here, again, the differences in F0 value within the first component phrase is due to the presence or absence of accentual boost we saw before. As for the second component phrase, not only the

peak value but also the phrase-initial and phrase-final valley values are markedly lower when following an accented phrase than when following an unaccented phrase.^{<18>} These differences are statistically significant as shown in Tables 10 and 11, which confirms that unaccented phrases are equally subject to downstep when following an accented phrase.

Table 10 Effect of Accent on [Valley2]: (All 20 df)

Pair	Accent	Mean	SD	t	P
(18a)	[+A,-A]	125.6	2.91	13.897	<.001
	[-A,-A]	144.5	3.47		
(18b)	[+A,-A]	125.5	1.86	10.773	<.001
	[-A,-A]	145.0	5.71		
(18c)	[+A,-A]	119.2	4.40	19.379	<.001
	[-A,-A]	150.4	3.04		

Table 11 Effect of Accent on [Peak2]: (All 20 df)

Pair	Accent	Mean	SD	t	P
(18a)	[+A,-A]	130.5	3.14	9.929	<.001
	[-A,-A]	144.5	3.47		
(18b)	[+A,-A]	138.5	2.54	5.897	<.001
	[-A,-A]	147.7	4.50		
(18c)	[+A,-A]	134.5	2.25	15.046	<.001
	[-A,-A]	150.9	2.84		

Table 12 Effect of Accent on [Valley3]: (All 20 df)

Pair	Accent	Mean	SD	t	P
(18a)	[+A,-A]	128.5	3.24	6.786	<.001
	[-A,-A]	138.0	3.32		
(18b)	[+A,-A]	133.9	2.81	5.957	<.001
	[-A,-A]	142.3	3.72		
(18c)	[+A,-A]	127.8	3.60	8.699	<.001
	[-A,-A]	140.5	3.24		

To summarize the evidence presented so far, it can be said that downstep is triggered by the accent of a given minor phrase and causes the lowering of pitch range in which following minor phrases, accented and unaccented alike, are realized. If we consider this finding together with the finding in Chapters Three and Four, it can be concluded that accent exerts its effect in two ways in the intonational realization of utterances. On the one hand, it exerts its effect leftwards, raising the phrase which bears it (accentual and preaccentual boost). It also exerts its effect in the rightward direction, on the other hand, triggering downstep, or a downward shift of pitch range where following phrases are realized.

2.1.2. Chaining of Downstep

Having confirmed that Poser's claims on the trigger and effect of downstep can be justified, let us next consider his third claim, that the lowering process chains. The data from my experiments provide evidence that downstep chains not only in the right-branching construction, which Poser successfully shows, but also in the left-branching construction, which he failed to consider.

2.1.2.1. Right-Branching Phrases

Poser's claim that downstep chains can be substantiated by the evidence from Dataset VII. This dataset includes some forty right-branching phrases consisting of three words or simplex phrases, which vary in the accentedness of the first two

components as shown in (19). Figures 5.7-5.10 illustrate the typical F0 contours shown by these four groups of right-branching noun phrases.

(19) Dataset VII: Right-Branching Phrases

<1a> [+A,+A,+A]

<1b> [-A,+A,+A]

<1c> [+A,-A,+A]

<1d> [-A,-A,+A]

Let us first compare the two pairs of phrases <1a> and <1b>, which differ in the accentedness of the first component. These pairs show F0 differences as schematized in Figure 5.11 whereby these two types of phrases are compared in regard to their mean peak and valley values. The fact that the first component phrases have substantially higher F0 values in <1a> than in <1b> is again due to the effect of accentual boost.^{<19>}

While the first component phrases are given higher F0 in <1a> than in <1b>, the second component phrases are realized at a much lower level in <1a> than in <1b>. This difference is statistically significant, as shown in Table 17 below, suggesting that the second component phrases have undergone downstep in <1a> but not in <1b>.

Table 17 Comparison of Two Accent Types: <1a> vs. <1b>
(df=20)

(I) Onset of the Second Component: [Valley2]

Accent type	Mean	SD	t	P
<1a> [+A,+A,+A]	144.4	5.78	9.223	<.001
<1b> [-A,+A,+A]	172.9	7.31		

(II) Peak of the Second Component: [Peak2]

Accent type	Mean	SD	t	P
<1a> [+A,+A,+A]	168.3	7.07	3.545	<.01
<1b> [-A,+A,+A]	178.9	5.19		

Having confirmed that downstep occurs over the first two elements of the phrases, let us see if the lowering process takes place over the second and third elements of the same set of phrases. The first and third types of phrases in (19) differ in the accentedness of the second component phrases. These two types of phrases exhibit F0 contours as in Figures 5.7 and 5.9. A comparison of these two types of phrases is summarized in Figure 5.12, from which it can be seen that the third component phrases have lower F0 values in <1a> than in <1c> although the reverse is true in regard to the second component phrases (because of the effects of the boost induced by accent).^{<20>} Table 18 shows that the F0 differences in the third component phrases are all statistically significant. This confirms that the third component phrases are downstepped with respect to the preceding words in <1a> but not in <1c>.

Table 18 Comparison of Two Accent Types: <1a> vs. <1c>
(df=20)

(I) Onset of the Third Component: [Valley3]

Accent type	Mean	SD	t	P
<1a> [+A,+A,+A]	133.8	5.52	7.863	<.001
<1c> [+A,-A,+A]	154.4	5.78		

(II) Peak of the Third Component: [Peak3]

Accent type	Mean	SD	t	P
<1a> [+A,+A,+A]	151.1	6.24	4.512	<.001
<1c> [+A,-A,+A]	162.2	3.63		

A comparison of the differences between <1a> and <1b>, as schematized in Figure 5.11, on one hand, and the differences between <1a> and <1c>, schematized in Figure 5.12, on the other, shows that downstep has taken place twice in <1a>, first between the first and second components and then between the second and third components. <21>

2.1.2.2. Left-Branching Phrases

The chaining effect of downstep is observed in the left-branching construction just as in the right-branching construction. Dataset VII includes some eighty left-branching phrases made up of three words (or simplex phrases) which, like the right-branching phrases in the same dataset (cf. (20)), fall into four groups depending on the accentedness of the first two components. (<2> and <3> represent the two types of left-branching structures — see the discussion in section 3.1.2 below as well as the account given in Appendix I.)

(20) Dataset VII: Left-Branching Phrases

- <2/3a> [+A,+A,+A]
- <2/3b> [-A,+A,+A]
- <2/3c> [+A,-A,+A]
- <2/3d> [-A,-A,+A]

Figures 5.13–5.16 illustrate the typical F0 patterns shown by these four types of noun phrases. Figure 5.17, which schematically compares the first two types of phrases on the basis of the mean peak and valley values, suggests that the second component phrases are higher in pitch in the sequences of three accented phrases than in the sequences of an unaccented phrase followed by two accented phrases.^{<22>} The differences in the onset and peak are statistically significant, as shown in Table 19, and this indicates that the second component phrases have undergone downstep when following an accented phrase but not when following an unaccented phrase.

Table 19 Comparison of Two Accent Types^{<23>}
<2/3a> vs. <2/3b> (df = 39)

(I) Onset of the Second Component: [Valley2]

Accent type	Mean	SD	t	P
<2/3a> [+A,+A,+A]	147.8	8.93	11.509	<.001
<2/3b> [-A,+A,+A]	174.5	4.68		

(II) Peak of the Second Component: [Peak2]

Accent type	Mean	SD	t	P
<2/3a> [+A,+A,+A]	162.7	4.84	11.214	<.001
<2/3b> [-A,+A,+A]	178.4	3.87		

Meanwhile, the first and third types of phrases in (20) (cf. Figure 5.13 and 5.15) exhibit substantial differences in the third component words, as is seen from the schematic figure in Figure 5.18.^{<24>} These differences are statistically significant, as shown in Table 20 below.

Table 20 Comparison of Two Accent Types: <2/3a> vs. <2/3c> (df=37)

(I) Onset of the Third Component: [Valley3]

Accent type	Mean	SD	t	P
<2/3a> [+A,+A,+A]	125.9	3.56	13.813	<.001
<2/3c> [+A,-A,+A]	147.8	6.24		

(II) Peak of the Third Component: [Peak3]



Accent type	Mean	SD	t	P
<2/3a> [+A,+A,+A]	148.2	4.33	7.357	<.001
<2/3c> [+A,-A,+A]	158.5	4.41		

From the comparison of the statistical results in Table 19 and Table 20, it can be said that left-branching phrases consisting of three accented elements undergo downstep twice, between the first and second elements and between the second and third elements.^{<25>} Considering this result together with the result discussed just above in section 2.1.2.1, it can be concluded that downstep chains both in right-branching and left-branching constructions, regardless of the syntactic configuration of the phrase involved. (I will show in sections 3 and 4 below that the two types branching structures show systematic differences in downstep patterns.)

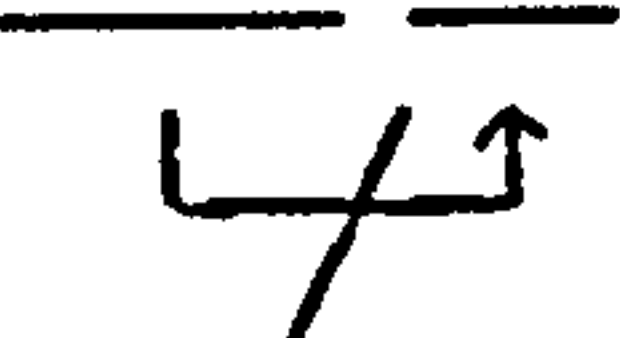
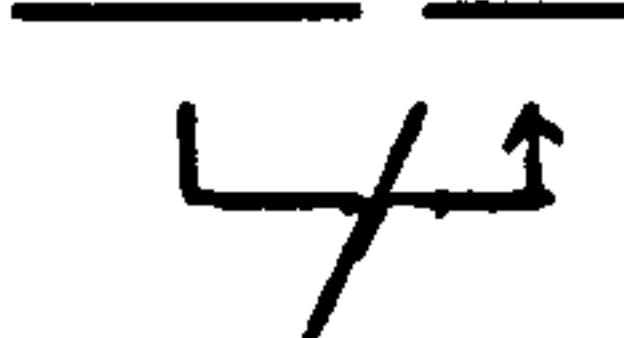
2.1.3. Representation of Downstep

The discussion so far has shown clearly the cause and effects of what I call downstep here. In brief, downstep is triggered by the presence of an accent in a given minor phrase and manifests itself as a shift of pitch range within which the following phrases are intonationally realized. If we adopt both the idea that intonational structures of Japanese utterances are represented tonally rather than accentually (cf. Chapter Four, section 1) and the assumption that the conventional tonal representation of abstract accents is correct, then it can be said that downstep is triggered by the sequence of High-Low tones (or, more simply, by a Low tone following a High tone) within a given minor phrase. (21) illustrates this.

(21) Downstep

Accent Rep.	uma'i nomi'mono	uma'i yamaimo
Tonal Rep.	LHL % LHLL	LHL % LHH
		

It must be noted in this regard that the sequence of a High tone followed by a Low tone does not trigger downstep if a minor phrase boundary intervenes between the two tones (cf. (22)). What this means is that the process of downstep is sensitive to the minor phrase boundary, which, in turn, suggests that phrase boundaries form an integral part of the intonational structure of Japanese. <26>

(22)	Accent Rep.	amai nomi'mono	amai yamaimo
	Tonal Rep.	LHH % L HLL	LHH % L HH
			

While the cause of downstep can thus be readily represented in tonal terms, its effect cannot be adequately expressed in tonal representation. Since downstep involves the lowering of a whole minor phrase, and this lowering effect can take place more than once within a given stretch of speech, tonal interpretation of the process would require more than two kinds of both High and Low tones, as illustrated in (23) below.

(23) Tonal Representation of Downstep (DS)

Accent Rep.	ao'i o'okina me'ron "blue big melon"
Tonal Rep. (Input to DS)	LHL % HLLL % HLL
Output of DS	LHL % H'L'L'L' % H"L"L"

The only way to solve this difficulty will be to define downstep at the stage where phonetic realization rules (PRRs) interpret tonal representation into F0 contours at the phonetic output. Under this analysis, downstep is defined as a phenomenon whereby PRRs lower the pitch register by making reference to the accent-related HL sequence in the tonal representation.

2.1.4. Where Previous Models Fail

The data presented in sections 2.1.1 - 2.1.2 provide evidence against the various intonational models outlined in section 1 and in favor of Poser's downstep model.

Fujisaki's contour interaction model, for example, fails to account for the basic fact that the downward trend of pitch in Japanese utterances is largely conditioned by phonological factors. To be more specific, Fujisaki's model cannot handle the fact that the rate of F0 declination is significantly greater when following accented words than following unaccented words. Since his model does not allow for the interaction between two successive minor phrases (except for the process of minor phrase formation, that is, his 'accent phrase formation'), it falsely predicts that a word following an accented word has the same F0 height as a word following an unaccented word. This flaw results from Fujisaki's belief that F0 declination takes place as a function of time, quite independently of the phonological structure of the sentence. It must be emphasized, however, that this flaw does not totally invalidate the basic notion underlying his model, that contours of different kinds are integrated to yield output intonational contours. As will be discussed in section 6 below, Japanese exhibits what can be described as a mechanical declination, in addition to the phonologically conditioned downstep. If this mechanical declination is to be defined as a function of time, all Fujisaki needs to do will be to refine the organization of his accent component in such a way that minor phrases interact with each other in some way or other.

While Fujisaki's error lies in his mistaken belief that the downward trend of pitch in Japanese is a purely phonetic phenomenon, models proposed on the phonological hypothesis are justifiable in their orientation. However, these models fail to

characterize downstep correctly in one way or another. McCawley's accent reduction theory, for example, falsely predicts that only accented minor phrases are subject to downstep, although it makes a correct prediction as to what triggers the intonational process.

McCawley's accent reduction model involves two more flaws. First, it falsely predicts that lowering takes place only in the high-pitched portion. As we saw above, it is not simply the high-pitched portion but the whole word or phrase that undergoes lowering when preceded by an accented word. Second, McCawley falsely assumes that in a sequence of three accented minor phrases, the second and third phrases are equal to each other in pitch height with the first phrase being higher than the other phrases. Since downstep chains, this assumption is obviously unjustified.

These two flaws of McCawley's model stem from its conception of the phonologically conditioned declination as a process to be wholly definable at the tonal level of phonological derivation. It is not essentially wrong to attribute the trigger of the process to a certain configuration of tonal representation, but it is misleading to assume that its effects can also be tonally represented. As pointed out above, tonal characterization of the intonational process inevitably requires us to postulate many degrees of High and Low tones, thereby increasing the complexity of the otherwise simple tonal system.

2.2. Other Tonal Effects on Downstep

The experimental data discussed in section 2.1 have shown (i) that declination in Japanese is primarily a phonologically conditioned phenomenon, and (ii) that Poser's experimental data are largely reproducible. While Poser is correct in his understanding of the trigger and effects of downstep, he did not go so far as to examine the extent to which the intonational process is affected by other phonological factors than accentedness. In this section, I will discuss how downstep interacts with two other phonological features characterizing minor phrases, accent location and phonological length. It will be shown that the two phonological features affect the two major features constituting downstep contours — accentual fall and the immediately following initial lowering. It will also be shown that the configuration of downstep nevertheless tends to be unaffected by the two phonological features because of the conspiratorial changes shown by accentual fall and initial lowering.

2.2.1. Two Competing Hypotheses

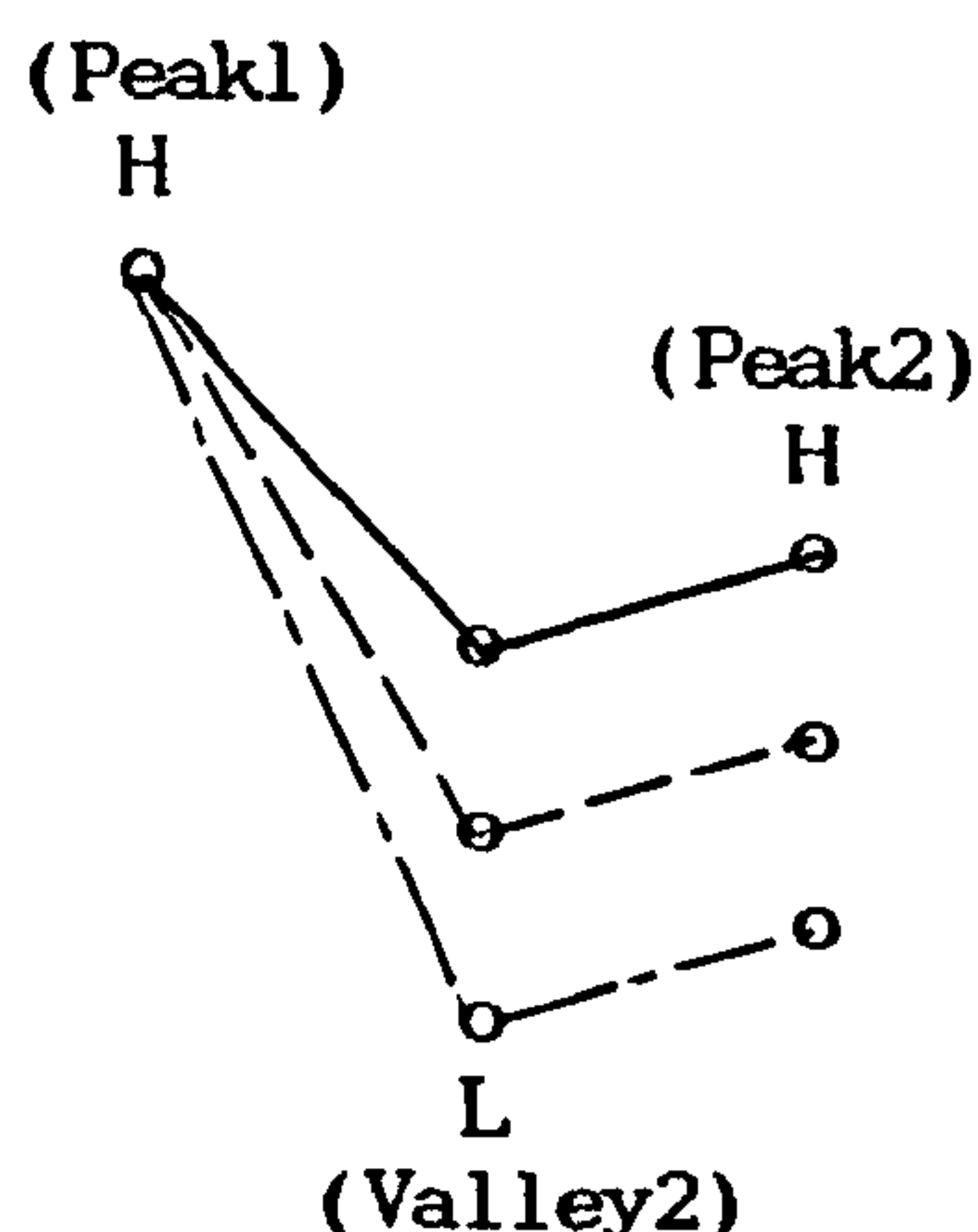
In Chapter Three (section 1), I explored the mechanism underlying accent-induced F0 fall. The discussion developed there can be summarized in the following three points. It was shown, first of all, that F0 drops continuously in the post-accentual position. Second, F0 tends to drop with the number of post-accentual Low-toned morae ('PALM') such that a greater PALM tends to induce a greater degree of accentual fall. And third,

the generalization based on the notion of 'PALM' holds true with the sequences in which the accented phrase is followed by an unaccented phrase as well as with the sequences in which it is followed by an accented phrase.

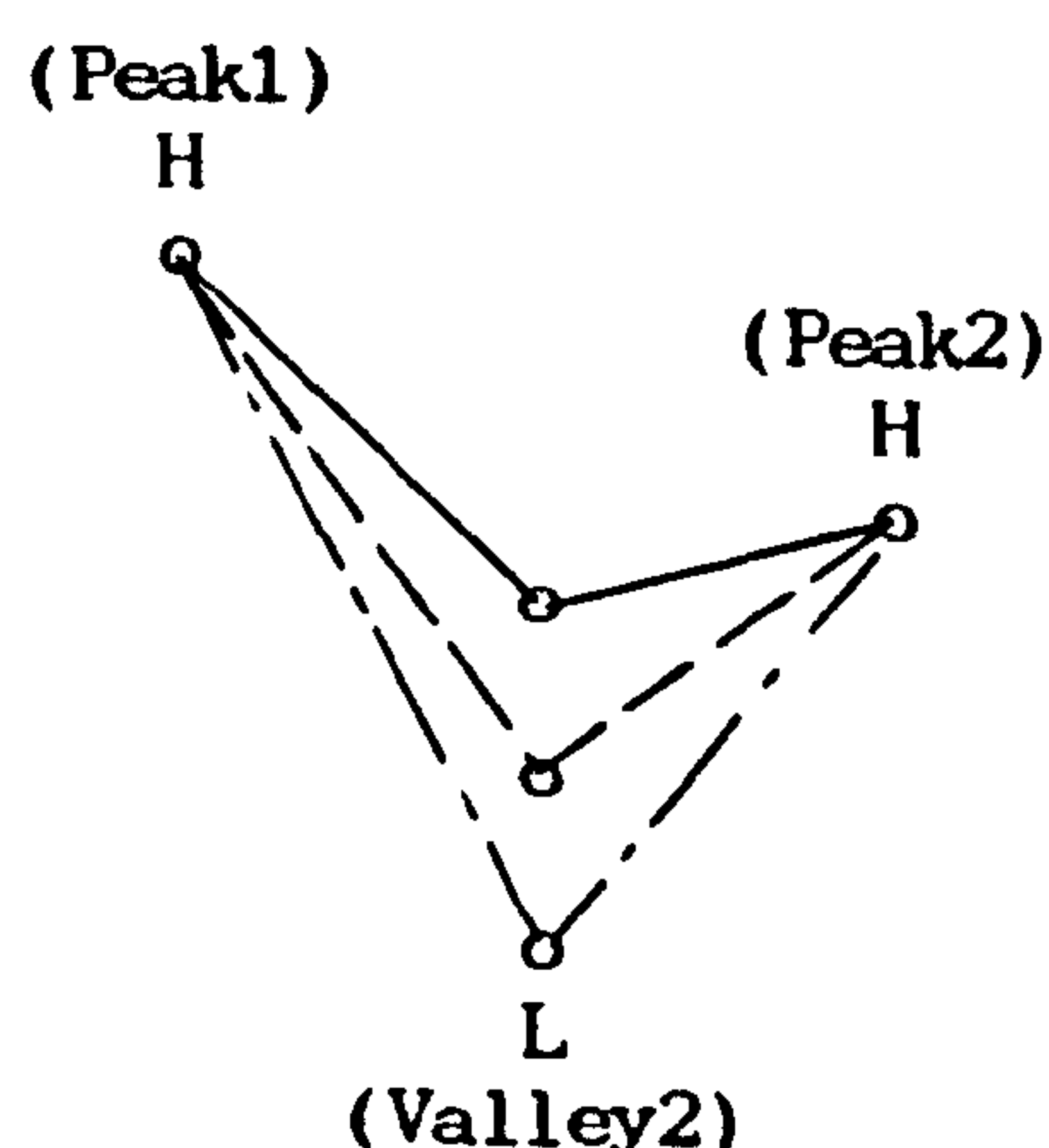
Given this characterization of accentual fall, one can think of two phonetic pictures for the interaction between downstep and accentual fall. (24) illustrates these two pictures by describing the downstep configuration as time-normalized schematic F0 contours.

(24)

(a)



(b)



The picture in (24a) assumes that F0 rises at a constant rate at the onset of the second phrase irrespective of the extent to which F0 drops as accentual fall. As for the configuration of downstep, it assumes that the inter-peak F0 difference becomes greater in proportion to the extent of the accentual fall.

While (24a) assumes that downstep is affected by the differences in the tonal structure of component phrases, the (24b) postulates that downstep is essentially unaffected by such phonological factors as the accent location and phonological length of component phrases. Under this interpretation, the peak of the second minor phrase is supposed to have a 'target' F0 value and, consequently, the inter-peak F0 difference remains basically constant irrespective of the differences in the phonological structures of component phrases. In descriptive terms, this means that the further F0 declines as a realization of accentual fall, the further F0 rises at the onset of the next minor phrase as if to minimize the effects which phonological differences exert on the configuration of downstep. In what follows of this section (sections 2.2.2-2.2.3), I will show that (24b) represents the true picture of what actually happens.

2.2.2. Data

Dataset V provides the three subsets of test phrases given in (25)-(27).

(25)	Accentual Rep.	Tonal Rep.	Gloss
a)	uma'i me'ron	LHL % HLL	'tasty melon'
b)	na'mano u'ni	HLL % HL	'uncooked sea-urchin'
c)	o'okina me'ron	HLLL % HLL	'big melon'
d)	yo'nmaino o'obaa	HLLLL % HLLL	'four overcoats'
e)	o'nosanno i'rui	HLLLLL % HLL	'Mr Ohno's clothes'

(26)	Accentual Rep.	Tonal Rep.	Gloss
a)	uma'i me'ron	HLL % HLL	'tasty melon'
b)	uma'i nomi'mono	HLL % LHLL	'tasty drink'
c)	nau'i iromo'yoo	HLL % LHLL	'fashionable design'
d)	uma'i maamare'edo	HLL % LHHLL	'tasty marmalade'

(27)	Accentual Rep.	Tonal Rep.	Gloss
a)	uma'i oimo	LHL % LHH	'tasty potato'
b)	na'mano oimo	HLL % LHH	'uncooked potato'
c)	o'okina oimo	HLLL % LHH	'big potato'
d)	yo'nmaino nurie	HLLLL % LHH	'four drawings'
e)	o'onosanno namae	HLLLLL % LHH	'Mr Ohno's name'

As outlined in Chapter Three (section 1), the test phrases in (25) all consist of initially accented words and phrases with an exception of (25a) which involve a medially accented word in the phrase-initial position. In tonal terms, these phrases involve a different number of Low-toned morae in the post-accentual position ("PALM(-within)"). The test phrases in (26), by contrast, involve the same tonal string in the initial component words and differ from one another in the tonal structures of the second component words. To be more specific, (26a) differs from (26b)-(26d) in containing a smaller number of Low-toned morae in the post-accentual position (PALM) although all the four phrases do not differ in the number of Low-toned morae within the first component (i.e. PALM-within). The test phrases in (27) are unaccented counterparts of (25): They all involve an unaccented word preceded by an accented word. In

tonal terms, they differ from one another in the number of Low-toned morae within the first component, while involving the same tonal string in the second component.

(28)–(30) summarizes the tonal structure of the phrases in (25)–(27) respectively, in regard to PALM and PALM-within (within the first component).

(28)

Phrase	PALM	PALM-within
(25a)	1	1
(25b)	2	2
(25c)	3	3
(25d)	4	4
(25e)	5	5

(29)

Phrase	PALM	PALM-within
(26a)	1	1
(26b)	2	1
(26c)	2	1
(26d)	2	1

(30)

Phrase	PALM	PALM-within
(27a)	2	1
(27b)	3	2
(27c)	4	3
(27d)	5	4
(27e)	6	5

The three subsets of test phrases show F0 contours as illustrated in Figures 5.1 and 5.4. Tables 21–23 give the mean F0 values of eleven tokens for the various parameters characterizing the F0 contours. [P(eak)1–V(alley)2] represents the F0 fall triggered by the accent of the first minor phrase

whereas [P(eak)2-V(alley)2] and [P(eak)1-P(eak)2] denote, respectively, the degree of initial lowering in the second minor phrase and the inter-peak difference of downstep contours. (Figures in brackets represent standard deviation (SD)).

Table 21 Summary of Mean Values and SD

Phrase	Peak1	Valley2	Peak2	P1-V2	P2-V2	P1-P2
(25a)	158.0 (4.45)	132.1 (3.96)	141.5 (4.39)	25.9 (3.56)	9.4 (3.78)	16.5 (2.81)
(25b)	160.4 (3.67)	123.6 (2.80)	137.4 (2.80)	36.7 (3.66)	13.8 (3.77)	23.0 (4.94)
(25c)	162.6 (3.72)	119.7 (3.00)	137.3 (3.35)	42.9 (3.70)	17.6 (2.50)	25.3 (3.07)
(25d)	163.1 (4.18)	115.5 (1.97)	139.7 (2.41)	47.6 (4.23)	24.2 (2.04)	23.4 (3.44)
(25e)	162.0 (3.74)	116.0 (2.65)	135.0 (2.86)	46.0 (4.07)	19.0 (2.76)	27.0 (4.17)

Table 22 Summary of F0 Values & SD

Phrase	Peak1	Valley2	Peak2	P1-V2	P2-V2	P1-P2
(26a)	158.0 (4.45)	132.1 (3.96)	141.5 (4.39)	25.9 (3.56)	9.4 (3.78)	16.5 (2.81)
(26b)	157.4 (3.23)	124.5 (5.61)	142.0 (5.27)	32.9 (3.70)	17.5 (3.78)	15.4 (4.78)
(26c)	159.2 (4.81)	124.2 (2.36)	142.1 (2.26)	35.0 (4.17)	17.9 (1.76)	17.1 (4.13)
(26d)	156.0 (3.82)	126.6 (4.10)	140.6 (4.08)	29.4 (2.06)	14.0 (3.19)	15.4 (3.23)

Table 23 Summary of Mean Values & SD

Phrase	Peak1	Valley2	Peak2	P1-V2	P2-V2	P1-P2
(27a)	158.0 (5.37)	125.6 (2.91)	130.5 (3.14)	32.4 (3.78)	4.9 (2.63)	27.5 (4.23)
(27b)	161.0 (4.56)	121.7 (1.40)	129.1 (2.95)	39.3 (3.80)	7.4 (2.50)	31.9 (3.94)
(27c)	162.1 (4.32)	120.1 (4.25)	129.1 (3.78)	42.0 (2.45)	9.0 (2.41)	33.0 (2.27)
(27d)	160.4 (4.15)	110.5 (2.91)	129.2 (4.21)	49.9 (3.28)	18.7 (3.56)	31.2 (2.27)
(27e)	162.6 (3.29)	112.5 (2.30)	124.5 (2.77)	50.1 (2.64)	12.0 (2.24)	38.1 (2.60)

2.2.3. Discussion

2.2.3.1. Inter-Peak Difference

Let us first focus onto the peak and initial lowering of the second minor phrase, that is, [Peak2] and [Peak2-Valley2]. A glance at the F0 values given in Tables 21-23 above suggests that the peak of the second minor phrase tends to remain more or less constant (varying within the range of 7 Hz or so) while the initial lowering of the same phrase seems to vary considerably from one test phrase to another (the variation range being nearly 15 Hz).

In Table 22, for instance, [Peak2] shows almost the same F0 value for all the test phrases in spite of the considerable differences in the preceding valley, i.e. [Valley2]. The greatest difference in [Peak2] is observed between (26c) and (26d) but it is not statistically significant:

($p(T=1.069, df=20) > .20$). What this suggests is that [Peak2] has a certain target value regardless of the F0 differences in its preceding parameters. To be more exact, initial lowering, [Peak2-Valley2], varies to compensate for the differences in [Valley2] to keep the value of [Peak2] constant. This interpretation can be supported by the high degree of correlation (negative correlation) between [Valley2] and [Peak2-Valley2], as shown in Figures 5.19 and 5.20. ^{<27>}

Since [Valley2] is also highly correlated with [Peak1-Valley2], as was shown clearly in Chapter Three (section 1), it can be anticipated that the degree of initial lowering (IL) should show a high degree of correlation with the degree of accentual fall (AF) that immediately precedes it. That this prediction is correct can be seen from Figures 5.21 and 5.22. ^{<28>}

The fact that F0 tends to rise at the onset of the second minor phrase in proportion to the immediately preceding F0 drop caused by accentual fall suggests that accentual fall and initial lowering conspire to keep constant the following peak and, consequently, the inter-peak F0 difference of downstep contours. To put it differently, this means that the F0 drop due to accentual fall and the F0 rise due to initial lowering covary with each other as if to minimize tonal effects on the configuration of downstep.

2.2.3.2. Peak Levels

We have concentrated so far on the effects which tonal structures of component minor phrases exert on the overall configuration of downstep contours. Before concluding our discussion on the tonal aspect of downstep, let us consider how peak F0 levels of minor phrases are influenced by their tonal structures as well as by those of their neighboring minor phrases.

A glance at the data in Tables 21-23 suggests that there may be a target value both for [Peak1] and [Peak2]. This observation is correct in the sense that the peak values do not vary so markedly as other parameters. A closer examination of the data suggests, however, that the peak F0 values may actually vary^{<29>} in a rather systematic way depending on the tonal structures of component minor phrases.

The data in Tables 21 and 23, for instance, suggest that [Peak1] tends to rise with the number of Low-toned morae that are involved in the post-accentual position (cf. Figure 5.23). The fact that no such tendency is found in Table 22 where the tonal structure of the first component words (and hence the value of PALM-within) was kept constant^{<30>} suggests that [Peak1] correlates not with 'PALM' but with 'PALM-within,' or the number of post-accentual Low-toned morae within a given minor phrase.

The fact that [Peak1] correlates with 'PALM-within' and not with 'PALM' suggests that the peak F0 value of an accented minor phrase is influenced by its own tonal structure but not by the

tonal structure of the following minor phrase. Stated conversely, the tonal structure of a given minor phrase does not affect the F0 characteristics of the (accented) minor phrase that precedes it over a minor phrase (mp) boundary. This is illustrated in (31) below:

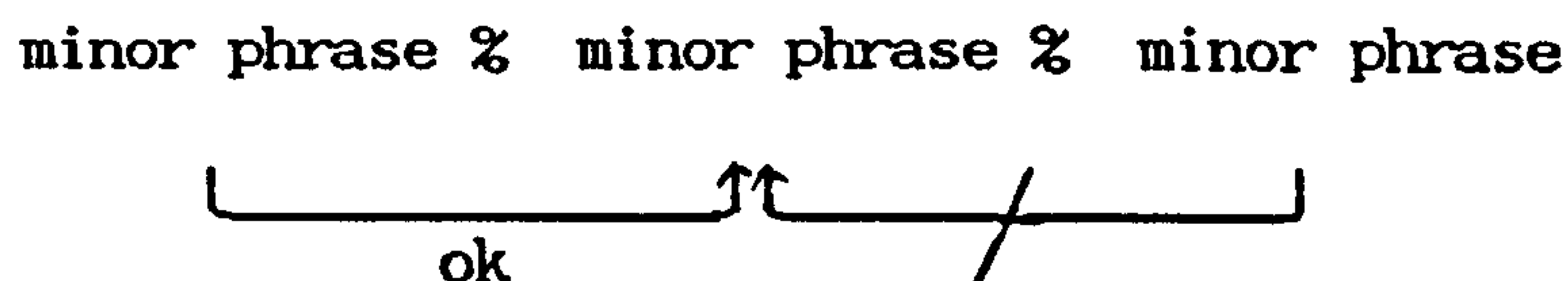


Just as [Peak1] varies slightly from one test phrase to another, [Peak2] shows a slight but noteworthy variation.^{<31>} The data in Tables 21 and 23 suggest that the value of [Peak2] tends, by and large, to decrease as the value of 'PALM-within' increases (Figures 5.24 and 5.25).^{<32>} Interestingly, Table 22 does not show a comparable tendency, which suggests that [Peak2] as well as [Peak1] varies depending on the number of post-accentual Low-toned morae defined within the first minor phrase (PALM-within), and not over the two minor phrases. Considered together with the finding discussed just above, this means that the tonal structure of a given accented minor phrase ('PALM-within' in our present discussion) affects not only its own peak (i.e. [Peak1]) but also the peak of the following minor phrase (i.e. [Peak2]). In more general terms, this implies that the tonal structure of a given minor phrase affects the F0 characteristics of the following minor phrase as well as those of its own.

The fact that the tonal structure of a given minor phrase influences the F0 characteristics of the phrase that follows it

apparently over the minor phrase boundary compares with the finding mentioned above, that the F0 characteristics of a given minor phrase is free from the effects of the tonal structure of the phrase that follows it. (32) schematizes this asymmetry.

(32)



3. METRICAL ASPECT OF DOWNSTEP

We saw in section 1 above that Poser's model of Japanese intonation assumes that syntactic information of sentences is exhaustively mapped onto phonological representation at the stage where sentences are phrased into the two kinds of intonational categories, major phrase and minor phrase, to form intonational representation. What this position implies is that two constructions of different syntactic structures should ceteris paribus show the same behavior as to downstep unless they yield different phrasing patterns.

Take the two types of phrases in (33), for example, which differ in branching structure. The conventional models of Japanese intonation as proposed by McCawley, Fujisaki and Poser predict that these two types of branching structures should either show a difference in intonational phrasing or exhibit identical patterns of declination. <33>

(33)

a) [[kowa'i] [[me'no] [ya'mai]]

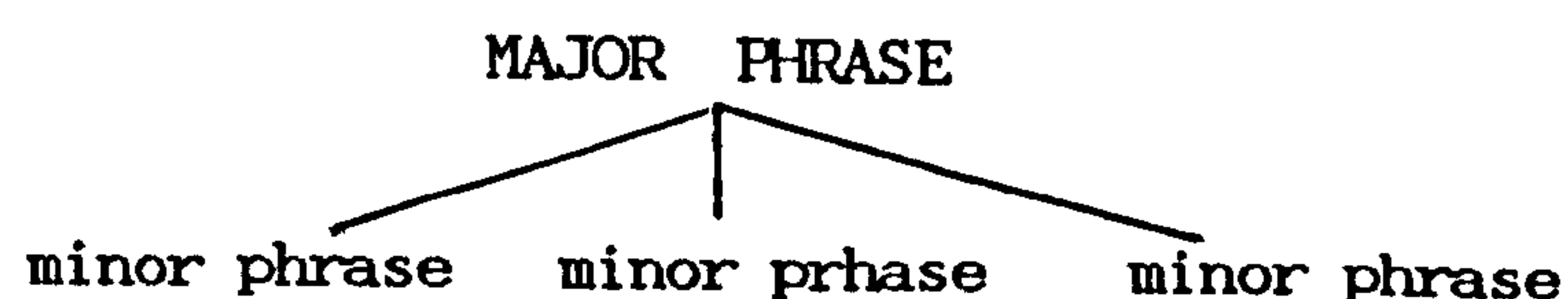
"fearful" "eye-Gen" "disease"
= "fearful eye disease"

b) [[[kowa'i] [me'no]] [oma'wari]]

"fearful" "eye-Gen" "policeman"
= "policeman with fearful eyes"

As has been mentioned in passing (cf. Chapter Three, section 2; section 2 of this chapter), phrases as in (33) generally yield three minor phrases in my data, with the second and third component words downstepped with respect to their respective preceding components (cf. Figures 5.7 and 5.13). Given that the two types of phrases thus yield one and the same pattern in intonational phrasing as in (34), the conventional models of Japanese intonation predict that they exhibit the same configuration of downstep contour. According to my own impressionistic observation, however, the two types of branching structures seem to show some systematic difference other than in intonational phrasing.

(34)



Prompted by this impression, I conducted a series of experiments as summarized in Datasets VII-X with a view to exploring the metrical aspect of downstep, or the effects of the syntactic structure of sentences on the configuration of downstep. In this section, I will first present the results of

these experiments and show that the intonational phenomenon yields different configurations depending on the syntactic structure of the sentence. I will propose the notion of 'metrical boost' to account for this syntactic effect on downstep. In the latter half of the section, I will further show that this notion plays a key role in generalizing the relation between syntactic structure and intonational structure in Japanese. This I take as evidence (i) that the intonational structure of Japanese is conditioned by the 'text' much more severely than has hitherto been assumed, and (ii) that the intonational representation (possibly the intonational phrasing structure) of Japanese is hierarchically organized just like syntactic representation.

3.1. Evidence

3.1.1. Dataset VIII

By way of introduction, let us first consider the syntactic effect on downstep with noun phrases consisting of three accented component words or phrases. Dataset VIII includes the four pairs of test phrases given in (35)–(38) which differ in the overall syntactic structure: (a) the right-branching structure and (b) the left-branching structure. The four pairs of phrases differ from one another in the accentedness of the component words: The pair in (35) involve the sequences of three accented words; the pairs in (36) and (37) involve an unaccented element flanked by accented words; and the pair in (38) consist of an accented element followed by two unaccented elements.

- (35) a) [ao'i [o'okina me'ron]]
 % LHL % HLLL % HLL %
 "blue" "big" "melon"
 = "an unripe big melon"
- b) [[ao'i re'monno] nio'i]
 % LHL % HLLL % LHL %
 "blue" "lemon-Gen" "smell"
 = "smell of a unripe lemon"
- (36) a) [o'okina [omoi me'ron]]
 % HLLL % LHH % HLL %
 "big" "heavy" "melon"
 = "a big heavy melon"
- b) [[o'okina mimino] o'okami]
 % HLLL % LHH % HLLL %
 "big" "ear-Gen" "wolf" = "a big-eared wolf"
- (37) a) [na'rano [yuumeina ryo'ori]]
 % HLL % LHHH % HLL %
 "Nara-Gen" "famous" "dishes"
 = "famous dishes of Nara"
- b) [[na'rano omiyano] eha'gaki]
 % HLL % LHH % LHLL %
 "Nara-Gen" "shrine-Gen" "picture card"
 = "a picture card of a shrine in Nara"
- (38) a) [na'rano [yuumeina omiya]]
 % HLL % LHHH % LHH %
 "Nara-Gen" "famous" "shrine"
 = "a famous shrine in Nara"
- b) [[na'rano omiyano] omamori]
 % HLL % LHH % LHH %
 "Nara-Gen" "shrine-Gen" "amulet"
 = "amulet of a shrine in Nara"

In tonal terms, the two phrases of each pair involve little or no difference at least as far as the first two components are concerned. Since the phonological (tonal) structure of a given minor phrase does not affect the F0 characteristics of its preceding minor phrases, as we saw in section 2.2 above, it can be assumed that the two phrases of each pair have one and the same phonological structure with respect to the first two component words. If the two phrases show any substantial F0 differences with these components, then it will follow that the differences result from the difference in branching structure.

3.1.1.1

Let us first compare the two phrases in (35). These phrases exhibit F0 contours as illustrated in Figures 5.26 and 5.27. Figure 5.28 schematizes the F0 contours of these two phrases on the basis of the averaged F0 values of major parameters. The results of t-test are given in Table 24.

Table 24 Dataset VIII: (35a) vs (35b)
(All 20 df)

Parameter	(35a/b)	Mean	SD	t	P
[Valley1]	(35a)	154.3	2.69	0.741	>.20
	(35b)	153.5	2.34		
[Peak1]	(35a)	169.7	1.95	1.801	>.05
	(35b)	171.8	3.34		
[Valley2]	(35a)	143.9	3.51	3.146	<.01
	(35b)	138.3	4.76		
[Peak2]	(35a)	158.9	4.35	9.883	<.001
	(35b)	142.6	3.32		
[Valley3]	(35a)	120.9	2.30	10.693	<.001
	(35b)	110.1	2.51		
[Peak3]	(35a)	138.2	4.92	5.400	<.001
	(35b)	128.8	3.03		
[P1-V2]	(35a)	25.8	4.77	4.010	<.001
	(35b)	33.5	4.20		
[P2-V2]	(35a)	15.0	4.45	5.944	<.001
	(35b)	4.4	3.98		
[P1-P2]	(35a)	10.8	4.24	10.083	<.001
	(35b)	29.2	4.33		
[P2-V3]	(35a)	38.0	4.34	3.716	<.01
	(35b)	32.5	2.30		
[P3-V3]	(35a)	17.3	4.71	0.886	>.20
	(35b)	18.7	2.28		
[P2-P3]	(35a)	20.7	5.82	3.459	<.001
	(35b)	13.8	3.16		

As for the first two minor phrases, the left-branching phrase (35b) exhibits a steeper inter-peak downstep slope than the right-branching counterpart (cf. Figure 5.29). Given that the two phrases do not show a significant difference in [Peak1], it can be said that this difference results from the difference the phrases show in the height of the second minor phrase, or

viewed differently, from the difference in the degree of initial lowering the two constructions show at the onset of the second minor phrase, i.e. [P(eak)2-V(alley)2].

Besides the differences in the first minor phrase, the two phrases in (35) show a substantial difference in the parameters relating to the third minor phrase such as [Valley3], [Peak3] and [P(eak)2-P(eak)3]. Given that the two phrases do not significantly differ in the degree of initial lowering at the onset of the third minor phrase, i.e. [P(eak)3-V(alley)3], it can be presumed that these differences stem from the differences in the second minor phrase, or more crucially, from the difference in [P(eak)2-V(alley)2]. If this interpretation is correct, it will follow that the difference in branching structure causes a change in pitch range in the second minor phrase, either by raising the right-branching phrase or, seen conversely, by lowering the left-branching phrase in that particular position. In other words, it follows that the pitch boost (or slump) in the second minor phrase involves the raising (or lowering) of the overall pitch range, not the local raising (or lowering) of the affected minor phrase alone.

3.1.1.2.

Although we have concentrated so far on the sequences of three accented minor phrases, it is important to point out that essentially the same kind of syntactic influence on the shape of downstep is observed in the sequences of three minor phrases in which the lowering process takes place only once. The three

pairs of phrases in (36)–(38) show F0 contours as illustrated in Figures 5.30–5.35. The F0 differences these contours exhibit are schematically shown in Figures 5.36–5.38 respectively. Tables 25–27 give the statistical comparison of the two types of branching structures in regard to the averaged F0 values of major parameters.

Table 25 Dataset VIII: (36a) vs (36b)
(All 20 df)

Parameter	(36a/b)	Mean	SD	t	P
[Peak1]	(36a)	171.9	3.18	0.474	>.20
	(36b)	172.7	4.61		
[Valley2]	(36a)	122.9	1.92	1.257	>.20
	(36b)	121.2	4.05		
[Peak2]	(36a)	141.2	2.27	3.274	<.02
	(36b)	136.4	4.30		
[Valley3]	(36a)	139.7	2.57	2.185	<.05
	(36b)	136.4	4.30		
[Peak3]	(36a)	148.7	2.94	2.931	<.01
	(36b)	144.8	3.28		
[P1–V2]	(36a)	49.0	3.32	1.852	>.05
	(36b)	51.5	2.98		
[P2–V2]	(36a)	18.3	3.35	2.214	<.05
	(36b)	15.2	3.19		
[P1–P2]	(36a)	30.7	3.47	3.830	<.01
	(36b)	36.4	3.41		

Table 26 Dataset VIII: Comparison of (37a) and (37b)
(All 20 df)

Parameter (37a/b)		Mean	SD	t	P
[Peak1]	(37a)	171.8	3.06	0.065	>.20
	(37b)	171.9	4.09		
[Valley2]	(37a)	126.4	2.84	0.168	>.20
	(37b)	126.6	2.73		
[Peak2]	(37a)	145.4	2.66	8.798	<.001
	(37b)	134.1	3.33		
[Valley3]	(37a)	139.4	4.37	4.899	<.001
	(37b)	131.5	3.08		
[Peak3]	(37a)	147.1	4.32	1.938	>.05
	(37b)	143.5	4.39		
[P1-V2]	(37a)	45.4	3.83	0.061	>.20
	(37b)	45.3	3.93		
[P2-V2]	(37a)	19.0	2.14	10.952	<.001
	(37b)	7.5	2.73		
[P1-P2]	(37a)	26.4	4.08	7.170	<.001
	(37b)	37.8	3.34		

Table 27 Dataset VIII: Comparison of (38a) and (38b)
(All 20 df)

Parameter (38a/b)		Mean	SD	t	P
[Peak1]	(38a)	173.5	3.33	0.090	>.20
	(38b)	173.4	1.57		
[Valley2]	(38a)	127.9	2.26	2.800	<.02
	(38b)	125.2	2.27		
[Peak2]	(38a)	144.1	2.26	11.399	<.001
	(38b)	134.7	1.56		
[Valley3]	(38a)	136.2	2.04	6.813	<.001
	(38b)	130.3	2.00		
[Peak3]	(38a)	136.9	2.39	2.683	<.02
	(38b)	134.5	1.75		
[P1-V2]	(38a)	45.6	2.91	0.069	>.20
	(38b)	48.2	1.99		
[P2-V2]	(38a)	16.2	2.18	6.147	<.001
	(38b)	9.5	2.88		

[P1-P2]	(38a)	29.4	2.07	10.690	<.001
	(38b)	38.7	2.01		

Like the pair of phrases in (35) — Table 24 — The two pairs of phrases in (36)–(38) show significant differences in regard to [Peak2-Valley2] and [Peak2], which lead to the differences in other parameters such as [Peak1-Peak2], [Valley3], [Peak3]. That is, the second minor phrase is relatively raised in the right-branching phrases as compared with the left-branching counterparts. Providing that the F0 contours of the left-branching phrases represent an unmarked configuration of downstep, it can be said that pitch register is relatively raised in the second minor phrase of the right-branching phrases as compared with the left-branching counterparts.

3.1.2. Dataset VII

3.1.2.1.

While Dataset VIII involves the analysis of many utterances (repetitions) of only a few phrases, Dataset VII compares the two types of branching structures by computing the average of many test phrases. As outlined in Appendix I, the latter dataset includes twenty-six noun phrases consisting of three accented component words or phrases. Of these test phrases, eight phrases have a right-branching structure like (33a), whilst the remaining 18 phrases involve a left-branching structure like (33b). The left-branching phrases fall into two types, loosely-bound or tightly-bound, depending on the degree of semantic

relatedness between the first two elements. (See Appendix I for a detailed account). For the sake of description, I have labeled the right-branching phrases as <1a> while labeling the two types of left-branching phrases as <2a> and <3a> respectively. (Some typical examples of these are given in (39) below.) These test phrases vary in tonal structure but, when averaged, the two sets of phrases — left-branching and right-branching — are not so different from each other with respect to such variables as 'PALM' and 'PALM-within' which might affect the phonetic parameters characterizing downstep contours.

(39) Dataset VII: Typical Examples

<1a> [kowa'i [me'no ya'mai]]

"fearful" "eye-Gen" "disease"
= "fearful eye-disease"

<2a> [[ma'mino eri'makino] iromo'yoo]

"Mami-Gen" "muffler-Gen" "design"
= "design of Mami's muffler"

<3a> [[a'warena mi'narino] o'yako]

"poor" "appearance-Gen" "parent and child"
= "poorly-dressed family"

The two types of branching structures in Dataset VII (<1a> vs. <2/3a>) typically exhibit F0 contours as given in Figures 5.7 and 5.13, in which each accented component forms an independent minor phrase.^{<34>} Figure 5.39 schematically compares these contours on the basis of the mean F0 values obtained. Table 28 summarizes the results of t-test, a statistical comparison of the right-branching and left-branching structures. ('R' and 'L' stand

for right-branching and left-branching respectively.)

Table 28 DATASET VII: <1a> vs <2/3a>
(All 24 df)

Parameter	R/L	Mean	SD	t	P
[Valley1]	R	165.0	6.89	0.595	>.20
	L	166.7	6.34		
[Peak1]	R	181.5	6.65	2.460	<.05
	L	187.6	3.30		
[Valley2]	R	144.4	5.78	1.159	>.20
	L	147.8	8.93		
[Peak2]	R	168.3	7.07	2.038	>.05
	L	162.7	4.84		
[Valley3]	R	133.8	5.52	3.724	<.01
	L	125.9	3.56		
[Peak3]	R	152.9	4.18	1.193	>.20
	L	148.2	4.33		
[P1-V2]	R	37.1	9.55	0.659	>.20
	L	39.8	9.87		
[P2-V2]	R	23.9	8.03	2.375	<.05
	L	14.9	10.67		
[P1-P2]	R	13.3	6.30	4.590	<.01
	L	24.9	5.17		
[P2-V3]	R	34.5	9.20	0.625	>.20
	L	36.8	7.33		
[P3-V3]	R	17.3	5.78	2.203	<.05
	L	22.3	4.21		
[P2-P3]	R	17.2	10.84	0.673	>.20
	L	14.4	6.88		

As in the case of the two phrases in (35), a crucial difference between the two sets of phrases apparently is found in the degree of initial lowering in the second minor phrase: the right-branching phrases a significantly greater degree of F0 rise than the left-branching counterparts.^{<35>} Unlike the two phrases in (35), however, the two sets of phrases do not show a significant difference in [Peak2] while showing a significant difference in [Peak1]. Although it is unclear why they differ in [Peak1] but not in [Peak2], the fact remains that the right-branching phrases involve a comparatively greater degree of F0 rise in the second minor phrase than the left-branching counterparts. And this difference leads to the significant differences in the degree of inter-peak downstep slope ([P(eak)1-P(eak)2]) as well as in [Valley3].

Before confirming these points with the other sets of test phrases from the same dataset (Dataset VII), let us briefly consider if there is any semantic effect on the configuration of downstep. Table 29 and Figure 5.40 compare the two types of left-branching phrases, <2a> loosely-bound phrases and <3a> tightly-bound phrases, in terms of the mean F0 values of major parameters.

Table 29 Dataset VII: <2a> vs <3a>
(All 16 df)

Parameter	<2/3a>	Mean	SD	t	P
[Valley1]	<2a>	168.3	1.04	0.359	>.20
	<3a>	167.6	5.73		
[Peak1]	<2a>	187.5	3.21	0.062	>.20
	<3a>	187.6	3.60		
[Valley2]	<2a>	140.9	5.51	4.162	<.001
	<3a>	153.3	7.13		
[Peak2]	<2a>	164.6	3.29	1.683	>.10
	<3a>	161.1	5.45		
[Valley3]	<2a>	124.9	1.89	1.234	>.20
	<3a>	126.8	4.39		
[Peak3]	<2a>	147.3	4.62	0.810	>.20
	<3a>	149.0	4.16		
[P1-V2]	<2a>	46.6	6.37	3.436	<.01
	<3a>	34.3	8.79		
[P2-V2]	<2a>	23.8	6.27	4.878	<.001
	<3a>	7.8	7.66		
[P1-P2]	<2a>	22.9	3.72	1.600	>.10
	<3a>	26.5	5.76		
[P2-P3]	<2a>	13.4	4.96	0.439	>.20
	<3a>	12.1	7.52		

The two types of left-branching structures show an essentially identical configuration of downstep, involving no significant differences in peak values or in the degree of inter-peak downstep slopes (i.e. [P(eak)1-P(eak)2], [P(eak)2-P(eak)3]). It may be claimed against this interpretation that they differ in the degree of the second initial lowering, [P(eak)2-V(alley)2] as well as in the degree of accentual fall between the first two minor phrases, [P(eak)2-V(alley)2], and in [Valley2]. These differences, however, can be related with

tonal differences between the two types of constructions. That is, as Table 30 shows, the value of 'PALM' over the first two minor phrases ('PALM1') is substantially greater in <2a> than in <3a>, which is expected to increase the accentual fall in the second minor phrase, [P(eak)1-V(alley)2], in <2a>. Since the degree of initial lowering is highly correlated with the degree of accentual fall which immediately precedes it, as was shown in section 2.2 above, it can be safely assumed that the value of the initial lowering in the second minor phrase, [P(eak)2-V(alley)2], is significantly greater in <2a> than in <3a>. This interpretation can be supported by the fact that <2a> and <3a> do not show a substantial difference in the value of 'PALM' over the second and third minor phrases ('PALM2'), and yield no significant differences in any of the parameters relating the last two minor phrases.

Table 30 Tonal Differences Between <2a> and <3a>

	'PALM1'	'PALM2'
<2a>	2.85	3.5
<3a>	1.50	3.7

3.1.2.2.

Returning to the main line of argument, Dataset VII contain not only the noun phrases consisting of three accented elements but also noun phrases as shown in (40) which have the same accentual structure as (37) and (38). These phrases fall into two groups, right-branching and left-branching phrases, which I have labeled as <1c> and <2/3c> respectively (cf. Figures 5.9 and

5.15).

(40) <1c> Right-Branching Phrases

e.g. [ao'i [momenno ori'mono]]

"blue" "cotton-Gen" "fabrics"
= "blue cotton fabrics"

<2/3c> Left-Branching Phrases

e.g. [[nau'i moyoono] eri'maki]

"trendy" "design-Gen" "muffler"
= "a muffler with a trendy design"

These two types of noun phrases show F0 differences as schematized in Figure 5.41. Table 31 summarizes the statistical result of the comparison.

Table 31 Dataset VII: <1c> vs <2/3c>
(All df 30)

Parameter	Phrase type	Mean(Hz)	SD	t	P
[Valley1]	<1c>	166.4	5.64	1.198	> .20
	<2/3c>	169.0	5.54		
[Peak1]	<1c>	186.2	8.01	0.803	> .20
	<2/3c>	188.4	4.79		
[Valley2]	<1c>	135.8	5.02	0.223	> .20
	<2/3c>	136.2	4.39		
[Peak2]	<1c>	158.0	5.53	3.353	< .01
	<2/3c>	150.8	6.20		
[Valley3]	<1c>	154.4	5.78	2.986	< .01
	<2/3c>	147.8	6.24		
[Peak3]	<1c>	162.2	3.63	2.535	< .02
	<2/3c>	158.5	4.41		
[P1-V2]	<1c>	49.6	9.87	0.760	> .20
	<2/3c>	52.2	6.41		
[P2-V2]	<1c>	22.2	4.56	3.767	< .001
	<2/3c>	14.6	6.73		

[P1-P2]	<1c>	28.0	8.76	2.992	<.01
	<2/3c>	37.6	6.79		

Like the test phrases considered so far, the two types of branching structures show a significant difference in the degree of initial lowering in the second element, [P(eak)2-V(alley)2], which leads to the differences in [Peak2] and the downstep slope, [P(eak)1-P(eak)2]. Differences in the other parameters may also be attributable to the difference in the initial lowering in the second element.

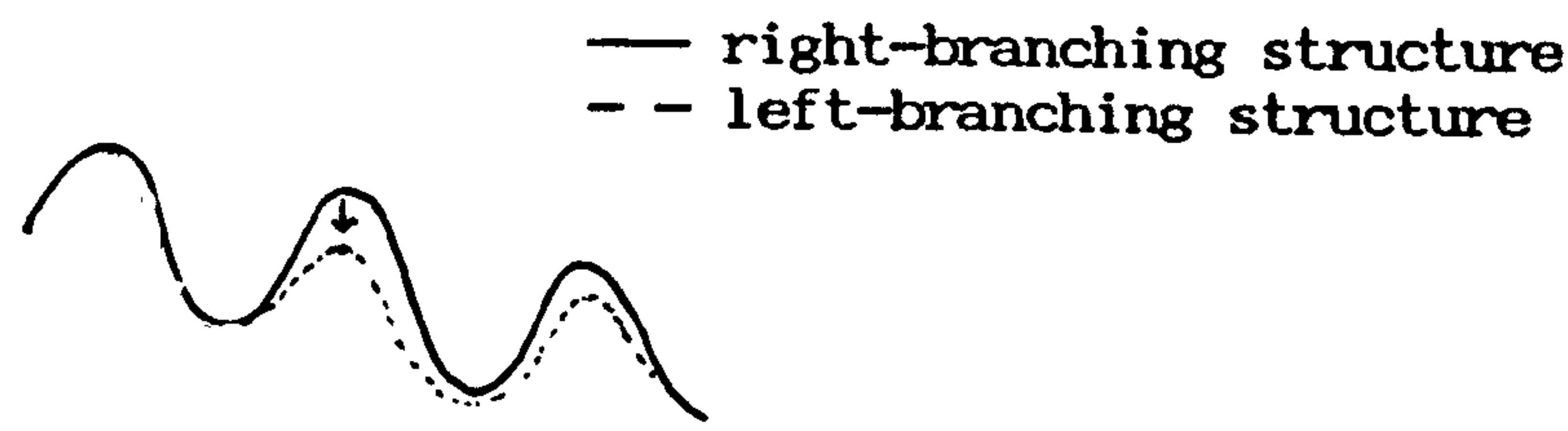
3.2. Arguments for Metrical Boost

The experimental data presented so far can be summarized in the following four points. First, the two types of syntactic structures, right-branching and left-branching, exhibit different behavior in regard to downstep in a systematic way. Second, the difference can be reduced to the difference in the degree of F0 rise at the onset of the minor phrase which contributes the difference in syntactic structure. That is, in the sequences of three minor phrases in which the second phrase is downstepped in relative to the first phrase, the second phrase is ceteris paribus realized at a higher F0 level in the right-branching structure than in the left-branching structure. Third, this difference in the height of the second minor phrase leads the (inter-peak) downstep slope to be steeper in the left-branching structure than in the right-branching counterpart. And fourth, the two types of branching structures show F0 differences in the subsequent minor phrase (in the third minor phrase in our present

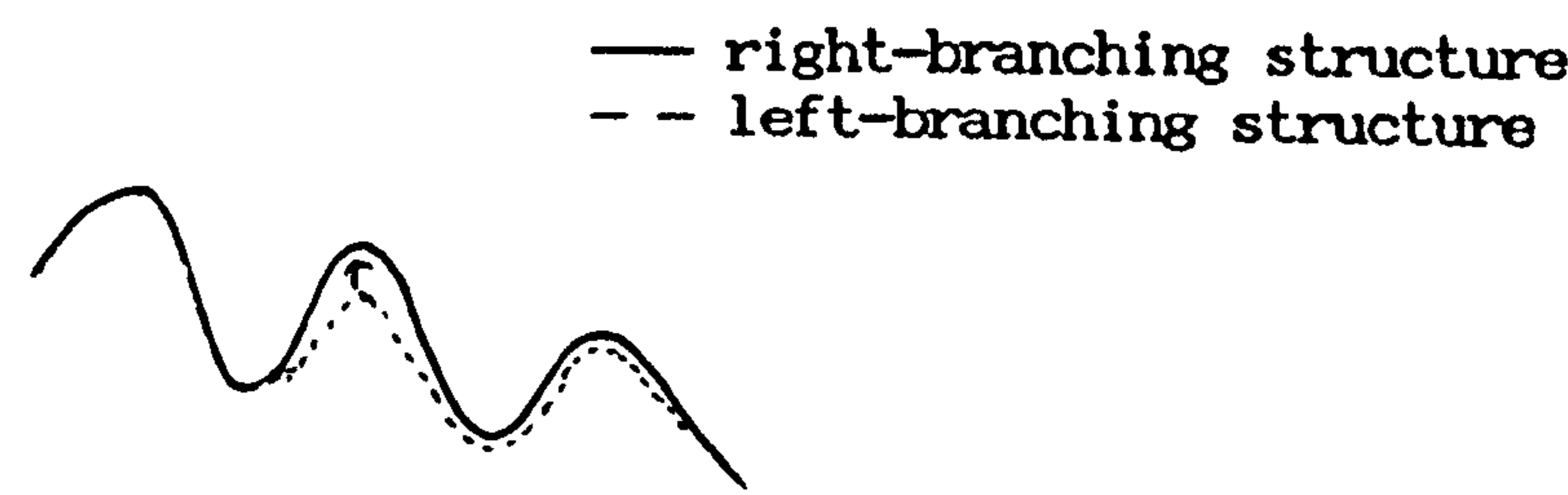
discussion), such as in the level of the inter-phrase valley ([Valley3]) and the peak of the third phrase ([Peak3]).

With these findings in mind, let us next consider how we can incorporate the syntax-related difference into the intonational theory of Japanese. Two solutions spring to mind. One solution will be to postulate that the left-branching structure induces a slump in pitch range in the second phrase in comparison with the right-branching structure. Alternatively, it will be equally possible to assume that the right-branching structure induces a boost of pitch range in the position in question. These two accounts, which I call theories of 'metrical slump' and 'metrical boost' respectively, can be illustrated as in (41) below:

(41)
(a) Analysis as 'Metrical Slump'



(b) Analysis as 'Metrical Boost'



Of these two models of the syntactic effect on downstep, I favor the analysis in (41b) for the following two reasons. It should be recalled, first of all, that the right-branching structure represents a marked structure in Japanese in general. This means not only that the language is a "left-branching language" (Kuno, 1973:6), but it also means that the right-branching structure shows marked prosodic behavior in Japanese in general by blocking such prosodic processes as accent phrase formation (APF; cf. Chapter Two), rendaku (sequential voicing process; cf. Chapter Two), minor phrase formation (MPF; cf. Chapter Four) and preaccentual boost (cf. Chapter Four). Given that the right-branching structure is a marked structure in the language in general, it will be more than natural to mark it in characterizing downstep while defining the left-branching structure as the unmarked structure.

A second line of evidence for the theory of metrical boost comes from the evidence to be discussed in section 4 below. In my data, such phrases as in (42) are realized as illustrated in Figures 5.48 and 5.52 with each component word constituting an independent minor phrase.

(42) (=16)) Dataset X

a) [[na'okono a'nino][ao'i eri'maki]]

"Naoko's brother's blue muffler"

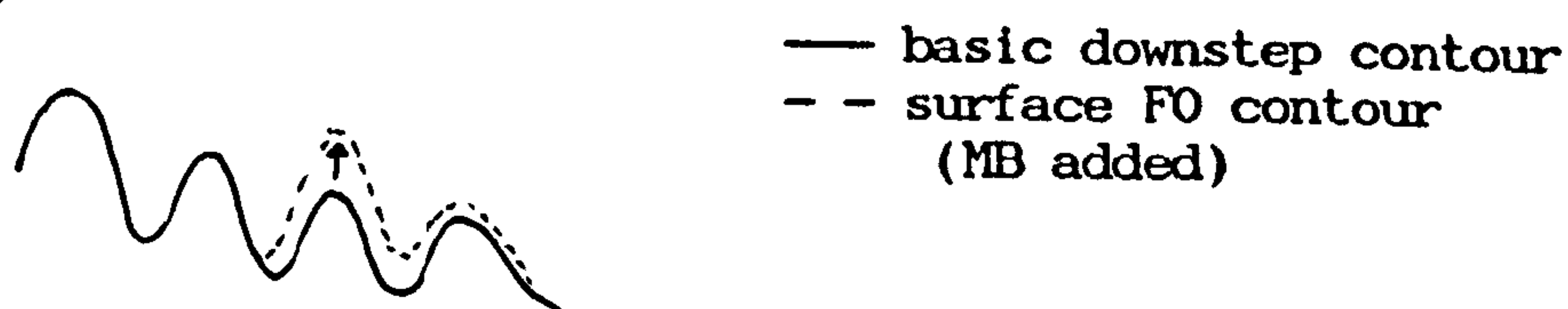
b) [[na'okono aneno][ao'i eri'maki]]

"Naoko's sister's blue muffler"

Given the contours as in Figures 5.48 and 5.52, the traditional intonational models of Japanese generally postulate that downstep has not applied between the second and third minor phrases in (42a) because the latter phrase is realized apparently at a higher F0 level than the former phrase. As we shall see in section 4, however, the intonational process has actually applied between the two minor phrases in the sense defined in section 2 above. That is, in comparison with the phrase in (42b), which differs from (42a) only in the accentedness of the second element, the phrase in (42a) realizes its third minor phrase at a relatively lower F0 level than the phrase in (42b).

The only way to account for this seeming paradoxical phenomenon in the current theory of Japanese intonation (including my own) will be to assume that the third minor phrase has been raised by the principle of metrical boost to such an extent that it is now realized higher than the second minor phrase which has triggered downstep. The effect of metrical boost (MB) in this case is illustrated in (43) below.

(43)



If, on the other hand, we apply the principle of metrical slump in this case, we can in no way account for the fact that

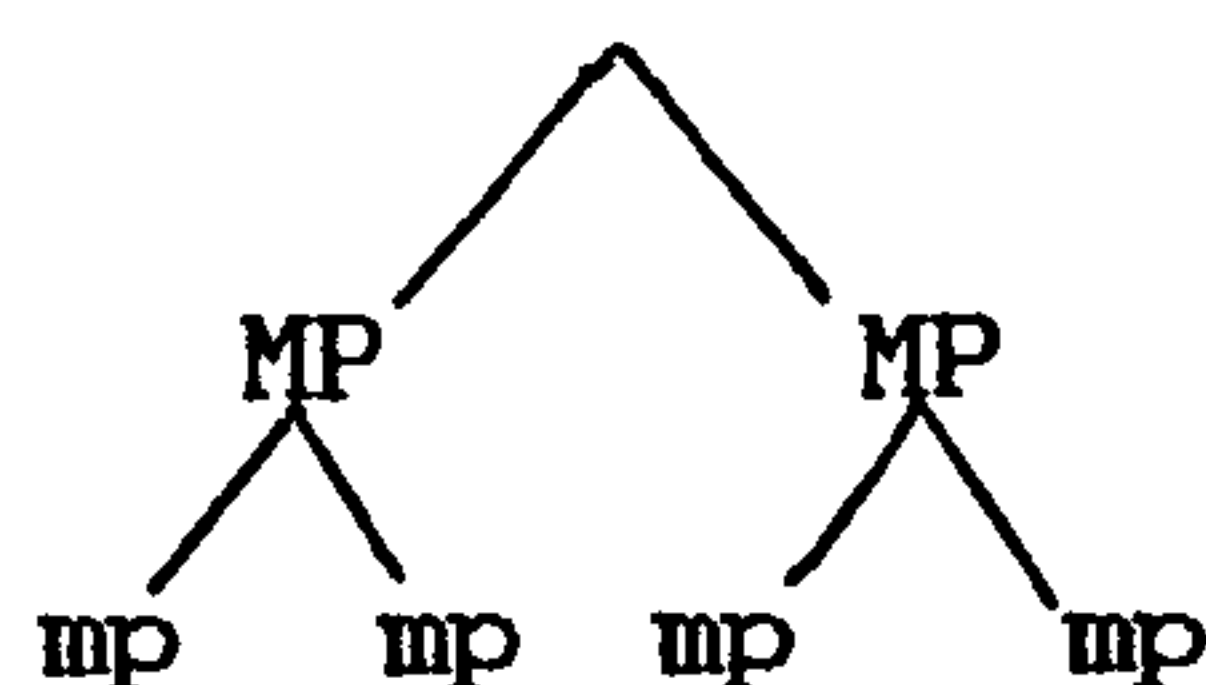
the third minor phrase in (42a) is higher in pitch than the second minor phrase but is still downstepped with respect to it according to the tonal definition of the process.

I have given two reasons to justify the analysis on the notion of 'metrical boost.' Before presenting more evidence for the syntactic effect on downstep and the notion of metrical boost, let us briefly consider the implications of the foregoing discussion for the modelling of Japanese intonation.

The simplest implication that emerges will be that the process of downstep involves two aspects, tonal and metrical. In the analysis I have proposed, the tonal aspect of downstep represents the more basic aspect of the intonational process by which the unmarked F0 contour is determined. The metrical aspect of downstep, by contrast, plays the role of modifying this contour by adding (superimposing) an extra F0 boost on the basic configuration of downstep in the marked right-branching structure.

Another implication we can get from the foregoing discussion concerns the fact that downstep requires information on the hierarchy of the syntactic structure. What this implies is that the intonational structure itself is hierarchically organized just like the syntactic structure. To be more specific, the syntactic effect on downstep cannot be adequately described by the pseudo-hierarchical intonational model as proposed by McCawley (1968) and Poser (1984), illustrated in (15) above (repeated below):

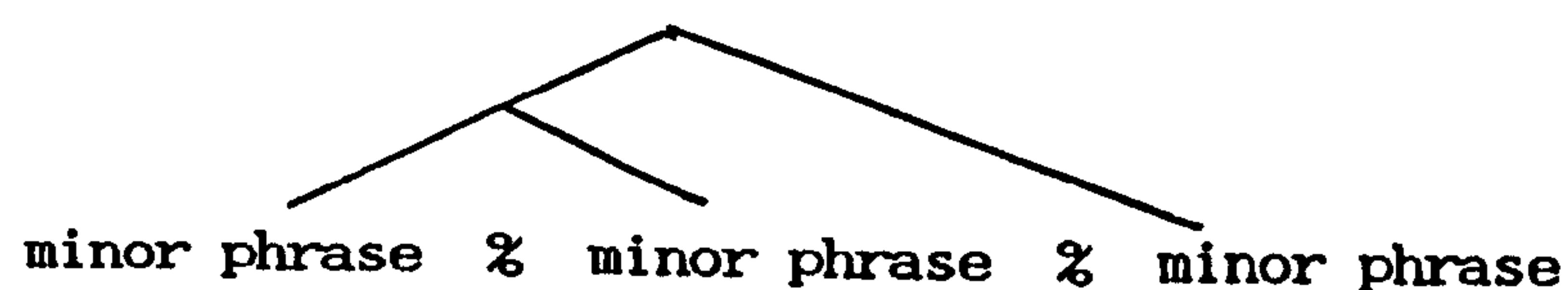
(15)



What we need instead is a model as illustrated in (44) below, whereby the intonational representation contains in some way or other the information on the hierarchy of syntactic structures. Metrical boost then is defined at the phonetic level of speech where phonetic realization rules add an extra F0 boost wherever a right-branching structure is involved, by reference to the hierarchy of the intonational representation. This implication will be discussed in a wider context later in this chapter. <36>

(44) Hierarchical Representation of Intonation

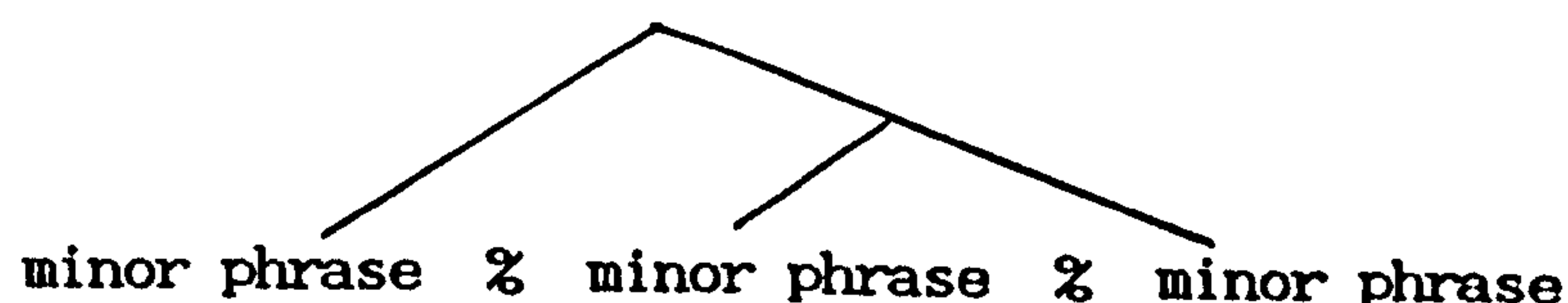
a) Left-branching structure



or

[[[mp₁] [mp₂]] [mp₃]]

b) Right-branching structure



or

[[mp₁] [[mp₂] [mp₃]]]

3.3. Further Evidence for Metrical Boost

In Section 3.1. I showed that the two types of branching structures exhibit a systematic difference with respect to downstep configuration, and put forward the notion of metrical boost to account for this difference. Although our discussion so far has concentrated on sequences of phrases involving up to three minor phrases, comparable observations can also be made about longer stretches of speech. In this section, I will present the data from Dataset IX and X to show that the phenomenon of metrical boost is widely observable in Japanese.

3.3.1. Dataset IX

Let us first consider the evidence from Dataset IX. This dataset contains many noun phrases of the two constituent types given in (45) below. All these phrases consist of four accented words and yield four minor phrases as illustrated in Figures 5.42-5.43.

(45) Dataset IX

a) [[A B][C D]]

e.g. [[a'ikono ne'esanno] [u'uruno eri'maki]]

"Aiko-Gen" "sister-Gen" "wool-Gen" "muffler"
= "Aiko's sister's woolen muffler"

b) [A [B [C D]]]

e.g. [[yu'mino [ao'i [yuni'ikuna eri'maki]]]

"Yumi-Gen" "blue" "unique" "muffler"
= "Yumi's blue unique muffler"

Table 32 Comparison of (45a) vs (45b)
(All 21 df)

Parameter	(45a/b)	Mean(Hz)	SD	t	P
[Valley1]	(45a) (45b)	177.1 177.1	12.65 14.80	0.000	>.20
[Peak1]	(45a) (45b)	195.4 191.5	7.15 5.33	1.472	>.20
[Valley2]	(45a) (45b)	134.1 129.8	5.15 9.56	1.356	>.20
[Peak2]	(45a) (45b)	155.9 165.2	8.20 8.72	2.636	<.02
[Valley3]	(45a) (45b)	119.3 127.1	6.44 10.61	2.149	<.05
[Peak3]	(45a) (45b)	158.4 158.4	7.38 5.81	0.000	>.20
[Valley4]	(45a) (45b)	117.9 121.8	4.93 10.73	1.134	>.20
[Peak4]	(45a) (45b)	138.7 140.9	3.90 5.95	1.057	>.20
[P2-V2]	(45a) (45b)	21.8 35.3	7.35 8.50	4.079	<.001
[P1-P2]	(45a) (45b)	35.9 26.3	12.78 7.51	2.986	<.01
[P3-V3]	(45a) (45b)	39.1 31.3	10.30 9.34	1.898	>.05
[P2-P3]	(45a) (45b)	-2.5 6.8	10.46 9.21	2.257	<.05
[P3-P4]	(45a) (45b)	19.7 17.5	6.33 6.90	0.797	>.20

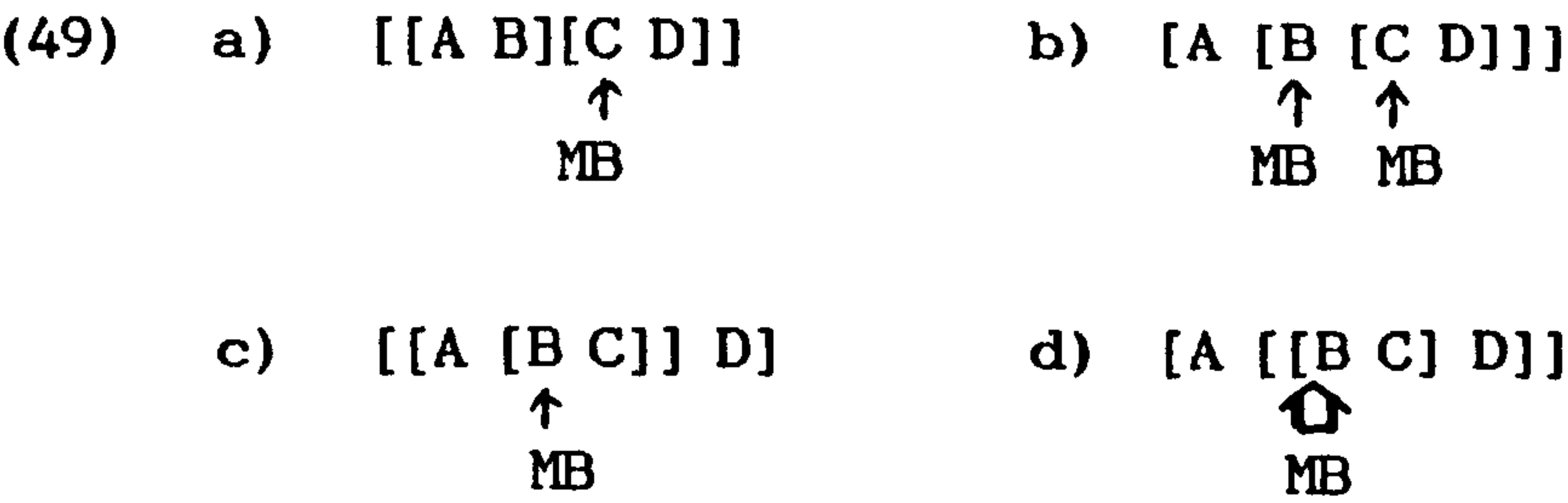
3.3.2. Dataset X

The notion of metrical boost is further borne out by the evidence from Dataset X, which includes the four phrases shown in (47). These four phrases vary slightly in the tonal structure of component elements (especially with the third element), but do not differ in accentedness with all the elements accented. As in the phrases in Dataset IX, these phrases are invariably realized in four minor phrases in the data obtained, with each word showing an independent initial lowering and accentual fall (cf. Figures 5.48-5.51).

(47) Dataset X^{<37>}

- a) [[na'okono a'nino][ao'i eri'maki]]
- % HLLL % HLL % LHL % LHLL %
- "Naoko-Gen" "brother-Gen" "blue" "muffler"
= "Naoko's brother's blue muffler"
- b) [ma'rikono [o'okina [ao'i eri'maki]]]
- % HLLL % HLLL % LHL % LHLL %
- "Mariko-Gen" "big" "blue" "muffler"
= "Mariko's big blue muffler"
- c) [[a'yakono [me'nno eri'makino]] iromo'yoo]
- % HLLL % HLL % LHLL % LHLL %
- "Ayako-Gen" "cotton-Gen" "muffler-Gen" "design"
= "design of Ayako's cotton muffler"
- d) [ao'i [[yu'mikoga a'nda] eri'maki]]
- % LHL % HLLL % HLL % LHLL %
- "blue" "Yumiko-Nom" "knit (past)" "muffler"
= "the blue muffler Yumiko knit"

organization of the syntactic trees, then it can be that the two types of phrases should show some difference in downstep configuration. To be more specific, if metrical boost is to be defined in reference to the overall syntactic structure of the phrases, it can be predicted that the effect of metrical boost should show up on a larger scale in the second element of (47d), which involves a double opening bracket, than in the same position of (47c), where a single opening bracket is involved. If this latter prediction is correct, the effect of metrical boost will show up as illustrated in (49) as opposed to (48).



Let us examine the experimental data with these different predictions in mind. Table 33 lists the mean F0 values of major parameters for each phrase type. Figures in brackets represent standard deviation.

Table 33 Summary of Data: Dataset X^{<38>}

Phrase type	Peak1	P2-V2	Peak2	P3-V3	Peak3	Peak4
(47a)	190.8 (4.24)	21.0 (3.46)	153.6 (4.36)	37.9 (3.23)	156.8 (3.66)	134.5 (3.00)
(47b)	194.3 (5.26)	37.0 (7.60)	168.8 (6.85)	33.1 (5.30)	154.8 (3.24)	139.4 (4.42)
(47c)	193.6 (5.16)	35.9 (8.05)	167.4 (8.53)	31.5 (2.32)	156.2 (4.39)	137.8 (3.49)
(47d)	183.8 (5.26)	48.2 (11.50)	192.1 (3.87)	28.0 (3.38)	150.7 (3.58)	136.2 (2.89)

Let us begin with the two parameters relating to the second minor phrase, that is, [Peak2] and [P(eak)2-V(alley)2], which denote the peak and initial lowering of the phrase respectively. As readily predicted by our theory of metrical boost, the phrase type (47a) shows substantial F0 differences from the rest for this minor phrase, differences which are statistically significant as shown in Tables 34 and 35 below (cf. Figure 5.54).

Table 34 Statistical Comparison (t-test)
[Peak2]: (All 22 df)

Phrases	t	P
(47a) vs (47b)	6.487	<.001
vs (47c)	4.272	<.001
vs (47d)	22.889	<.001

Table 35 Statistical Comparison (t-test)
[Peak2-Valley2]: (All 22 df)

Phrases	t	P
(47a) vs (47b)	6.639	<.001
(47c)	5.889	<.001
(47d)	7.839	<.001

While these statistical results confirm that the phrases in (47b)-(47d) are subject to metrical boost in the second minor phrase, it is worth noting that the phrase in (47d) shows substantially higher F0 values for the same minor phrase than (47b) and (47c) (cf. Figure 5.55). These differences too are statistically significant as shown in Tables 36 and 37 below.

Table 36 Statistical Comparison (t-test)
[Peak2]: (All 22 df)

Phrases	t	P
(47d) vs (47b)	10.255	<.001
(47d) vs (47c)	9.114	<.001
cf. (47b) vs (47c)	0.443	>.20

Table 37 Statistical Comparison (t-test)
[Peak2-Valley2]: (All 22 df)

Phrases	t	P
(47d) vs (47b)	2.814	<.02
(47d) vs (47c)	3.037	<.01
cf. (47b) vs (47c)	0.958	>.20

The fact that (47d) shows a greater degree of metrical boost than (47b) and (47c) suggests that metrical boost is not an all-or-none phenomenon but something which requires an n-ary interpretation.^{<39>} That is, the degree to which right-branching structures are subject to metrical boost is not uniform but varies depending on the overall constituent structure of the whole phrase. This compares with the findings about the two types of phrasing processes in Japanese prosody, Accent Phrase Formation (APF) and Minor Phrase Formation (MPF). As we saw in Chapter Two and Chapter Four respectively, these phrasing processes fail to apply where a right-branching structure is involved but do not differentiate between the two types of branching structures in (47c) and (47d). The difference between the phenomenon of metrical boost and these two types of phrasing processes lies in that the former is an n-ary phenomenon and the latter a binary phenomenon. In other words, while APF and MPF

requires the syntactic information of where a right-branching structure is involved, metrical boost further requires information as to how the prosodically marked structure is involved. This observation further substantiates the view I developed above that intonational structure involves a hierarchical organization just as syntactic structures do.

Having confirmed that our theory of metrical boost makes correct predictions as to the relative height of the second minor phrase, let us next consider the effect of the extra F0 boost on the third minor phrase. The model of metrical boost schematized in (49) predicts that the third minor phrase should be higher in (47b) (= (49b)) than in (47c) (= (49c)) because (47b) is subject to the F0 boost in this position while (47c) is not. Similarly, the third minor phrase is expected to have a higher F0 level in (47d) (= (49d)) than (47c) (= (49c)) since metrical boost is claimed to raise not just one minor phrase concerned but the whole pitch range in which subsequent minor phrases are also realized.

The data in Table 33, however, do not accord with these predictions. There is no significant difference, for instance, between (47b) and (47c) in the height of the third minor phrase (cf. Table 38). Similarly, the third minor phrase in (47d) is realized at a lower F0 level than the third minor phrase in (47c) (cf. Table 39).

Table 38 Comparison of (47b) and (47c)
(df=22)

Parameter	t	P
[Peak3]	0.889	>.20
[P3-V3]	0.958	>.20

Table 39 Comparison of (47c) and (47d)
(df=22)

Parameter	t	P
[Peak3]	3.374	<.01
[P3-V3]	2.966	<.01

This disagreement may be attributable to the tonal difference between the two phrases. The two phrases in (47b) and (47c), for example, show a substantial difference in the tonal structure of the third minor phrase, with the former containing only one post-accentual Low-toned mora within the phrase ('PALM-within') while the latter involves three morae.^{<40>} Since the peak F0 value of a given accented minor phrase tends to increase as its value of 'PALM-within' increases (cf. Section 2.2), the phrase in (47c) should, if other conditions were equal, have a higher peak for the third minor phrase than the phrase in (47b). For the same reason, the phrase in (47c) is expected to have a higher peak for the third minor phrase than those of the tonal structure in (47d). Given these tonal differences and the expected F0 differences they can possibly yield, it will not be so unrealistic to postulate that the differences in tonal structure have masked, as it were, the effects of metrical boost at the phonetic output.

While more detailed inquiries will be required into the interaction between the tonal effects and metrical effects on F0 contours, the fact remains that the notion of metrical boost can account reasonably well for the F0 differences shown by the four different syntactic structures in (47) which would otherwise remain unexplained. Seen from the viewpoint of intonational representation, it can be said that the four phrases in (47) have the intonational representation as in (50) and that an extra F0 boost is added onto the basic downstep contour wherever a right-branching structure is involved, as illustrated in (49) above.

(50) a) (= (47a))

[[% HLL % HLL %] [% LHL % LHLL %]]

b) (= (47b))

[% HLL % [% HLLL % [% LHL % LHLL %]]]

c) (= (47c))

[[% HLL % [% HLL % LHLLL %]] % LHLL %]

d) (= (47d))

[% LHL % [[% HLLL % HLL %] % LHLL %]]

4. TONAL AND METRICAL INTERACTION

In section 2 we have confirmed the validity of Poser's claim that downstep is a shift in pitch range triggered by accent, or by the sequence of High-Low tones involving no minor phrase boundary in between, in tonal terms. We have then seen in section 3 that the ups and downs of the F0 contours are also influenced metrically, that is, by the syntactic configuration of

the sentence. Having understood that downstep in Japanese involves the two aspects, tonal and metrical, let us next consider the way the two aspects of the intonational process interact with each other and see if there is any further evidence for metrical boost.

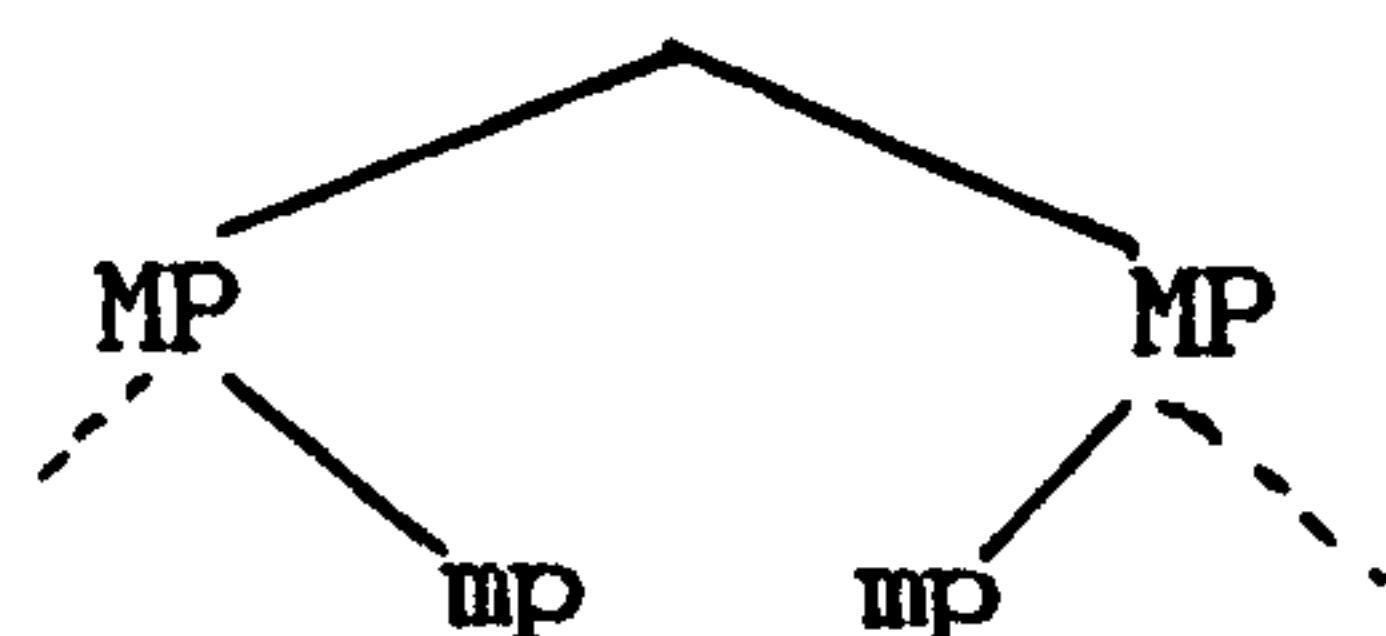
4.1. Evidence

It was pointed out in section 1 that the previous intonational analyses of Japanese including those proposed by McCawley, Fujisaki and Poser tend to define the intonational category of major phrase and the process of downstep primarily on the basis of surface F0 contours. Given the F0 contour as in (51) below, for example, it has been generally thought that the contour comprises two major phrases with the two minor phrases belonging to different major phrases (cf. (52)), and that downstep has not applied between the two minor phrases because it is blocked by a major phrase boundary.

(51)

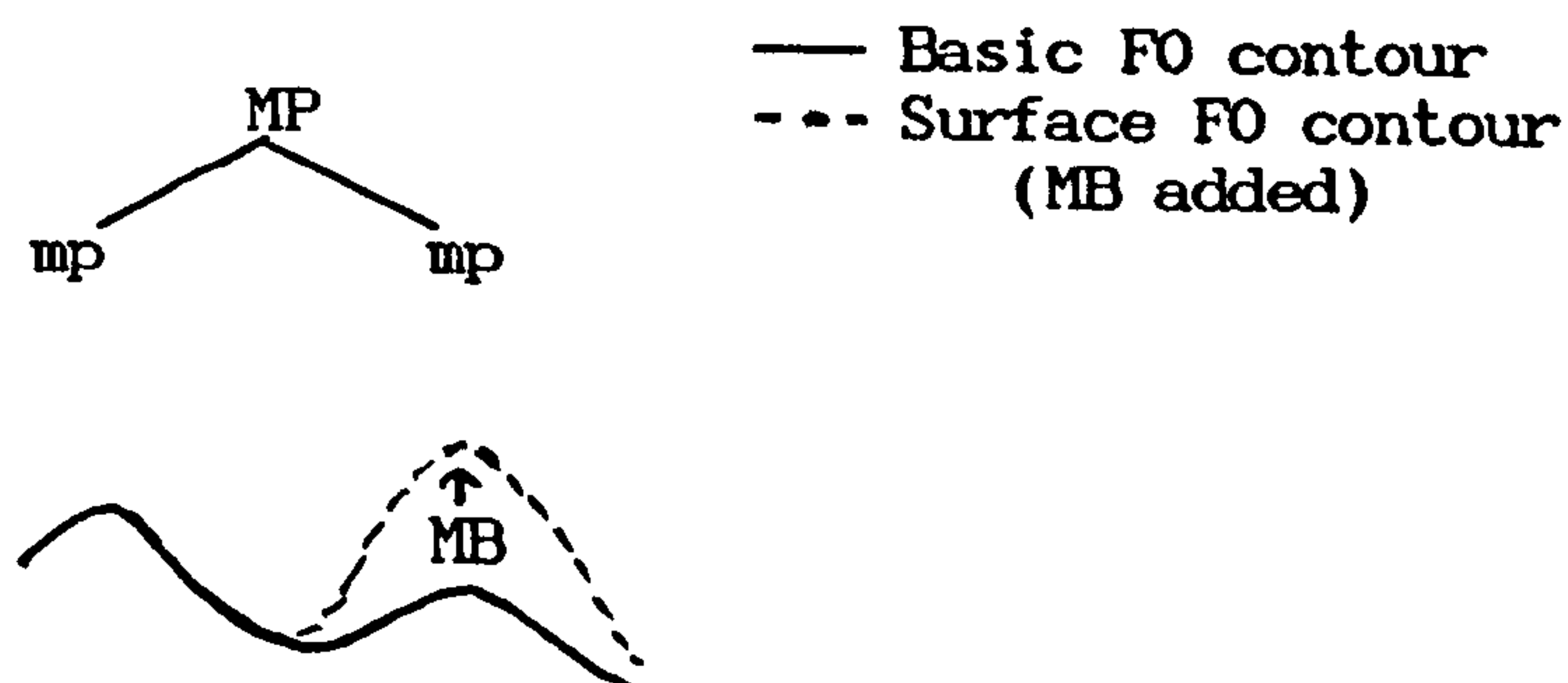


(52)



While the previous intonational models generally assume that the two minor phrases in (51) belong to different major phrases between which no downstep has applied, our theory of downstep does not define either downstep or major phrase on the basis of the surface F0 configuration of the sentence. Under the analysis I have proposed, downstep involves not only the tonal aspect but also the metrical aspect. What this analysis implies is that a downstepped minor phrase can be realized at a higher F0 level than its preceding minor phrase which has triggered the downstep if it is subject to metrical boost. If we tentatively adopt the definition of 'major phrase' as the domain of downstep, as many researchers actually do, it will follow that surface F0 contours cannot be taken as a reliable index in defining 'major phrase' (and its boundaries) and, in more general terms, the intonational representation of utterances. (53) illustrates the intonational analysis of the contour in (51) under this interpretation.

(53) Analysis as Metrical Boost (MB)



Dataset X contains two phrases which can give an interesting hint as to this question. The two phrases in (54) below are identical with each other both syntactically and tonally, except

for the accentedness of the second words: a'nino "brother's" and aneno "sister's".

(54) (= (16), (42)) Dataset X

a) [[na'okono a'nino][ao'i eri'maki]]

% HLLL % HLL % LHL % LHLL %

"Naoko-Gen" "brother-Gen" "blue" "muffler"
= "Naoko's brother's blue muffler"

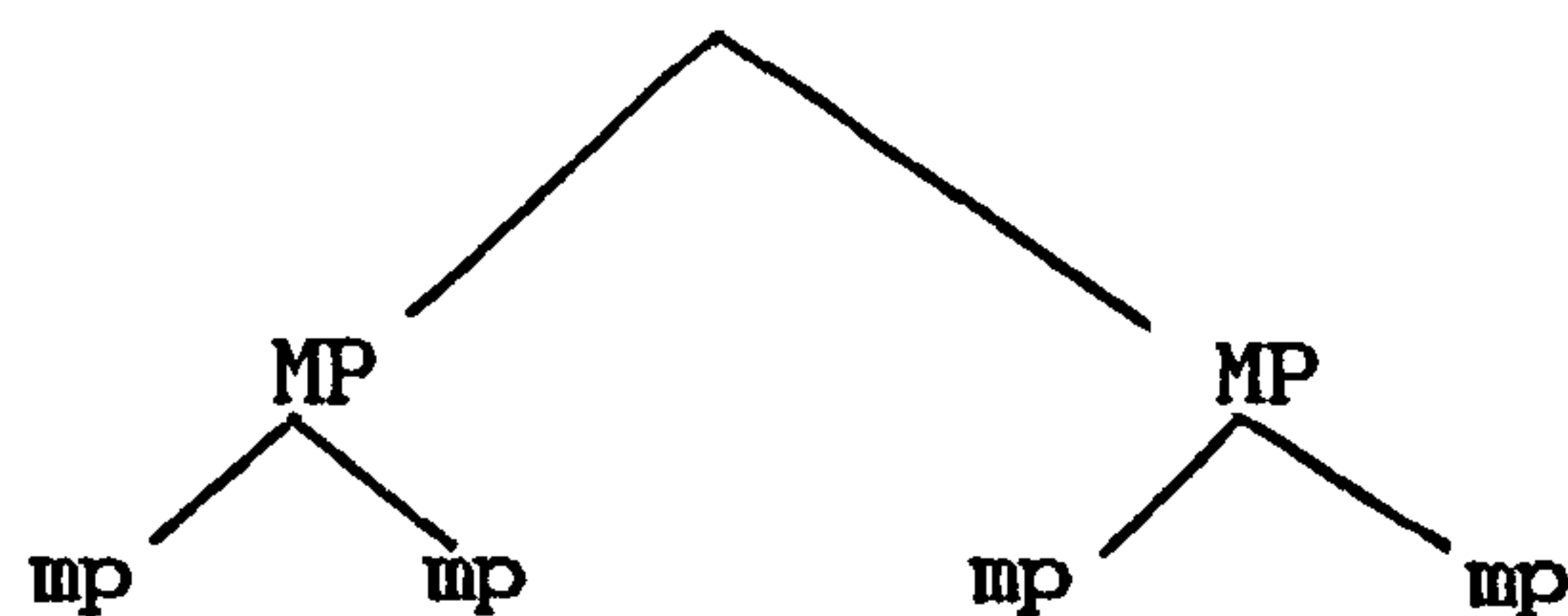
b) [[na'okono aneno][ao'i eri'maki]]

% HLLL % LHH % HLL % LHLL %

"Naoko-Gen" "sister-Gen" "blue" "muffler"
= "Naoko's sister's blue muffler"

Figures 5.48 and 5.52 show typical F0 contours of these phrases. As is seen clearly from these figures, the third minor phrase is realized at a higher F0 level than the second minor phrase in both of the phrases. The traditional models of Japanese intonation assume for these contours the intonational representation as in (55) below whereby the second and third minor phrase belong to different major phrases.

(55)



As for the second minor phrase, it is predicted that the accented phrase in (54a) should be higher than the unaccented phrase in (54b) because of the effect of accentual boost as

discussed in Chapter Three (section 2). As for the third minor phrase, however, the traditional models predict no significant F0 difference between (54a) and (54b) since downstep (or any other relevant intonational process) fails to apply over a major phrase boundary.

While the traditional models assume a major phrase boundary between the second and third minor phrases in (54a) (Figure 5.48) and (54b) (Figure 5.52), our downstep theory assumes that downstep has applied between the second and third minor phrases in (54a). Under this theory, the fact that the third minor phrase is realized at a higher F0 level than the second phrase in (54a) and (54b) is attributed to the syntactic configuration of the phrases, that is, to the effect of metrical boost which applies to the third minor phrase, thereby raising the pitch range in which the minor phrase (and possibly the fourth minor phrase as well) is realized. If this interpretation is tenable, it can be predicted that the the third minor phrase ao'i is lower in (54a) than in (54b).

With these competing predictions in mind, let us see the experimental data. Figure 5.56 compares the two contours on the basis of the averaged F0 values at peaks and valleys. As is seen from this figure, (54a) manifests its second minor phrase at a higher F0 level than (54b) as a realization of accentual boost. This difference is statistically significant as illustrated in Table 40.

Table 40 Summary of Data: (54a) vs (54b)
(All 22 df)

Parameter	(54a/b)	Mean(Hz)	SD	t	P
[Valley2]	(54a)	132.6	2.68	5.433	<.001
	(54b)	125.7	3.47		
[Peak2]	(54a)	153.6	4.36	7.329	<.001
	(54b)	141.8	3.46		

While the second minor phrase is higher in (54a) than in (54b), Figure 5.56 shows that the third word ao'i is substantially higher in (54b) than in (54a). That this difference is statistically significant is shown in Table 41.

Table 41 Summary of Data: (54a) vs (54b)
(All 22 df)

Parameter	(54a/b)	Mean(Hz)	SD	t	P
[Valley3]	(54a)	118.9	3.34	13.561	<.001
	(54b)	136.8	3.14		
[Peak3]	(54a)	156.8	3.66	4.259	<.001
	(54b)	163.7	4.25		
[Valley4]	(54a)	120.5	3.12	3.125	<.01
	(54b)	123.5	3.32		

4.2. Discussion

To summarize the results in Table 40 and Table 41, it can be said that the second minor phrase is higher in (54a) than in (54b) while the third minor phrase is higher in (54b) than in (54a). As one may recall, this is exactly the same situation as we saw in defining the tonal aspect of downstep in section 2.1 (cf. Figure 5.3). Namely, (54a) has a higher value for [Valley2] and [Peak2] than (54b) due to the effect of accentual boost, whereas (54a) has a lower value for [Valley3] and [Peak3] (and

also for [Valley4]) than (54b) because of the effect of downstep. In fact, the only difference between the various cases we saw in section 2.1 and the case under consideration now is simply that in the latter the downstepped minor phrase is given a higher pitch than the minor phrase which has triggered the intonational process. In other words, (54a) involves the lowering of pitch range between the second and third minor phrases although the latter minor phrase is realized at a higher F0 level than the former phrase. These experimental results clearly show that it is our theory of downstep and not the traditional models as envisaged in (55) that makes a correct prediction as to the intonational structure of the contours given in Figures 5.48 and 5.52.

In addition to this, the seemingly paradoxical situation that has emerged gives several important implications for the nature of downstep and the intonational category of Japanese. First, it casts doubt on the approach whereby intonational processes are defined solely on the basis of the surface configuration of F0 contours. In the discussion of downstep it is wrong to judge a priori that the lowering process has not taken place between two minor phrases simply because the second of the two minor phrases is realized higher than the first phrase (cf (51)). As the data have shown, downstepped minor phrases can be realized higher in pitch than their preceding minor phrase which triggered the intonational process.

Second, and more important, the experimental evidence given substantiates the claim I made in the foregoing section, that

downstep involves not only tonal but also metrical aspect, and that this metrical aspect can be generalized by the notion of metrical boost. To put it in general terms, the possible range of F0 patterns which a given sentence or phrase can take is determined not only by its tonal structure but also by its metrical (syntactic) structure. To be specific, the F0 contour of the phrase in (54a), as shown in Figure 5.48, is constructed by the superimposition of the metrically induced F0 boost (i.e. metrical boost) onto the basic downstep F0 contour which was determined by the tonal structure of the phrase.

(56) [[na'okono a'nino][ao'i eri'maki]]

% H L L L % H L L % L H L % L H L L %

a) Tonally Determined Basic Downstep Contour



=> b) Metrical Boost Added



The experimental evidence gives an interesting implication for the definition of major phrase too. It implies that just as the surface shapes of F0 contours cannot be taken as a reliable index of downstep, we cannot rely on the surface F0 patterns in defining the intonational category. As long as we define 'major phrase' as the domain of downstep, the fact that the intonational process can be defined between the second and third

minor phrases in (54a) — (56) — constitutes evidence that the two minor phrases belong to one and the same major phrase. What appears to be the division of major phrases is, in fact, no more than a gesture of metrical boost added onto the basic downstep contours defined by the tonal structure of the phrase.

Seen in this light, one may rightly ask if boundary phenomena (or 'juncture' phenomena) which have been attributed to the gesture of a major phrase (or analogous) boundary (cf. Han, 1962; Ueno et al., 1979; 1980; 1981) can be all handled by the notion of metrical boost. In the absence of relevant experimental data, I cannot substantiate this speculation any further at the moment. However, in view of the fact that intonational structures of utterances (of which 'major phrase' putatively forms an integral part) have been identified a priori on the basis of the surface configuration of F0 contours, it must be admitted that there is a good chance of this speculation being verified. If this can be shown, it will follow that 'major phrase' can be totally dispensed with in the intonational theory of Japanese. If so, it will follow that 'minor phrase' is the only relevant intonational category and that all we need to explore in the description of Japanese intonation is the way minor phrases interact with each other to constitute the hierarchical structure of intonational representation.

5. RHYTHMIC ASPECT OF DOWNSTEP

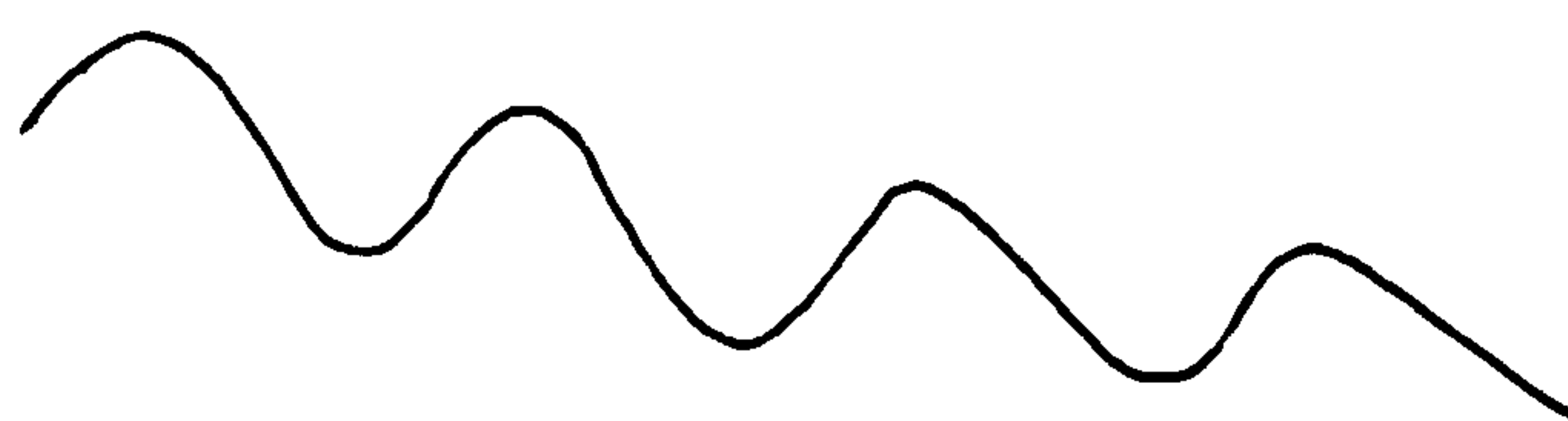
The foregoing discussion has fully shown that two independent principles — tonal and metrical — underly the process of downstep in Japanese. In addition to these two principles, Japanese downstep involves another aspect which I term the 'rhythmic principle.' This principle is observed in uniformly left-branching phrases consisting of four (or more) accented words, to which the principle of metrical boost is not, by definition, applicable.

Given that left-branching phrases consisting of three accented elements generally yield an F0 contour as shown in (57) (cf. Figures 5.13 and 5.27), it can be assumed that uniformly left-branching phrases made up of four accented words yield an F0 contour as in (58) with each minor phrase realized lower than the minor phrase immediately preceding it.

(57)



(58)



What actually happens in my data, however, is that the third minor phrase is realized as high as (or even higher than) the second minor phrase, making the phrases intonationally indistinguishable as a whole from the symmetrically branching structure given in (59b) below.

(59) a) Uniformly Left-Branching Structure

[[[A B] C] D]

b) Symmetrically Branching Structure

[[A B][C D]]

In this last section on downstep, I will first present experimental evidence to show this phenomenon, and then claim that it is the principle of rhythmic alternation discussed in Chapter Two (section 3.4) and Chapter Four (section 6.4) that underlies this phenomenon.

5.1. Evidence for Rhythmic Boost

5.1.1. Dataset IX

Dataset IX contains the two types of phrases as given in (60) which differ from each other primarily in syntactic structure. ^{<41>}

(60) a) Uniformly Left-Branching Phrases

e.g. [[ma'rikoga no'nda][wa'inno nio'i]]

"Mariko-Nom" "drank" "wine-Gen" "smell"
= "the smell of the wine which Mariko drank"

b) Symmetrically Branching Phrases

e.g. [[a'ikono ne'esanno][u'uruno eri'maki]]

"Aiko-Gen" "sister-Gen" "wool-Gen" "muffler"
= "Aiko's sister's woolen muffler"

The type of the phrase in (60b) is subject to metrical boost in the third element which, as we saw in section 4 above, is realized higher than the element immediately preceding it. By contrast, the phrase type in (60a) does not involve a right-branching structure and is, therefore, free from the effect of the syntactically-induced F0 boost. As mentioned above, if Japanese downstep involves the tonal and metrical aspects and nothing else, it can be predicted that the uniformly left-branching phrases should manifest the unmarked basic downstep contour intact, with the F0 level gradually descending from the first minor phrase to the last (cf. (58)).

As seen from Figure 5.44, however, the actual F0 contours shown by this type of phrases exhibit a boost in the third minor phrase which is quite similar to the effect of metrical boost in evidence in Figure 5.42. As a result of this F0 boost, the two types of phrases in (60) come to show a very similar F0 contour to each other (cf. Figure 5.57).

That these two types of phrases exhibit essentially the same

configuration of downstep is clearly seen from the statistical results given in Table 42.

Table 42 Summary of Statistics: Dataset IX
(All 19 df)

Parameter	Phrase type	Mean (Hz)	SD	t	P
[Peak1]	(60a)	191.8	6.18	1.263	>.20
	(60b)	195.4	7.15		
[Peak2]	(60a)	153.0	6.36	0.928	>.20
	(60b)	155.9	8.20		
[Peak3]	(60a)	153.8	6.59	1.544	>.10
	(60b)	158.4	7.38		
[Peak4]	(60a)	135.4	5.89	1.549	>.10
	(60b)	138.7	3.90		
[P1-P2]	(60a)	38.8	6.87	0.160	>.20
	(60b)	35.5	12.78		
[P2-P3]	(60a)	-0.8	8.68	0.415	>.20
	(60b)	-2.5	10.46		
[P3-P4]	(60a)	18.4	7.47	0.441	>.20
	(60b)	19.7	6.33		

5.1.2. Dataset X

The observation that the uniformly left-branching structure is intonationally neutralized with the symmetrically branching structure is further supported by the evidence from Dataset X. This dataset includes the two phrases given in (61) which are comparable to the two types of phrases in (60).

(61)

- a) [[[a'ikoga a'nda] eri'makino] iromo'yoo]
 % H L L L % H L L % L H L L L % L H H L L %
 "Aiko-Nom" "knit" "muffler" "design"
 = "the design of the muffler which Aiko knit"
- b) [[na'okono a'nino][ao'i eri'maki]]
 % H L L L % H L L % L H L % L H L L %
 "Naoko-Gen" "brother-Gen" "blue" "muffler"
 = "Naoko's brother's blue muffler"

These phrases exhibit F0 contours as illustrated in Figures 5.53 and 5.48, in both of which the third minor phrase is raised to such an extent that it is higher than the second minor phrase. A statistical comparison of the two contours is given in Table 43 (cf. Figure 5.58).

Table 43 Summary of Statistics: Dataset X
 (All 22 df)

Parameter	Phrase type	Mean (Hz)	SD	t	P
[Peak1]	(61a)	192.8	6.09	0.935	>.20
	(61b)	190.8	1.50		
[Peak2]	(61a)	153.6	3.37	0.000	>.20
	(61b)	153.6	1.58		
[Peak3]	(61a)	158.9	5.30	1.129	>.10
	(61b)	156.8	3.66		
[Peak4]	(61a)	137.7	2.99	2.623	<.05
	(61b)	134.5	3.00		
[P1-P2]	(61a)	39.2	4.51	1.439	>.10
	(61b)	37.2	1.71		
[P2-P3]	(61a)	-5.3	3.75	1.193	>.10
	(61b)	-3.2	4.81		
[P3-P4]	(61a)	21.2	5.24	0.558	>.20
	(61b)	22.3	4.36		

While the two constituent structures somehow show a significant difference in the height of the fourth minor phrase, [Peak4],^{<42>} they nevertheless exhibit essentially identical F0 pattern in regard to downstep. That is, the third minor phrase in the test phrase (61a) is realized higher than expected as if to break up a long chain of gradually descending downstepped minor phrases into two parts.

5.2. Arguments for Rhythmic Boost

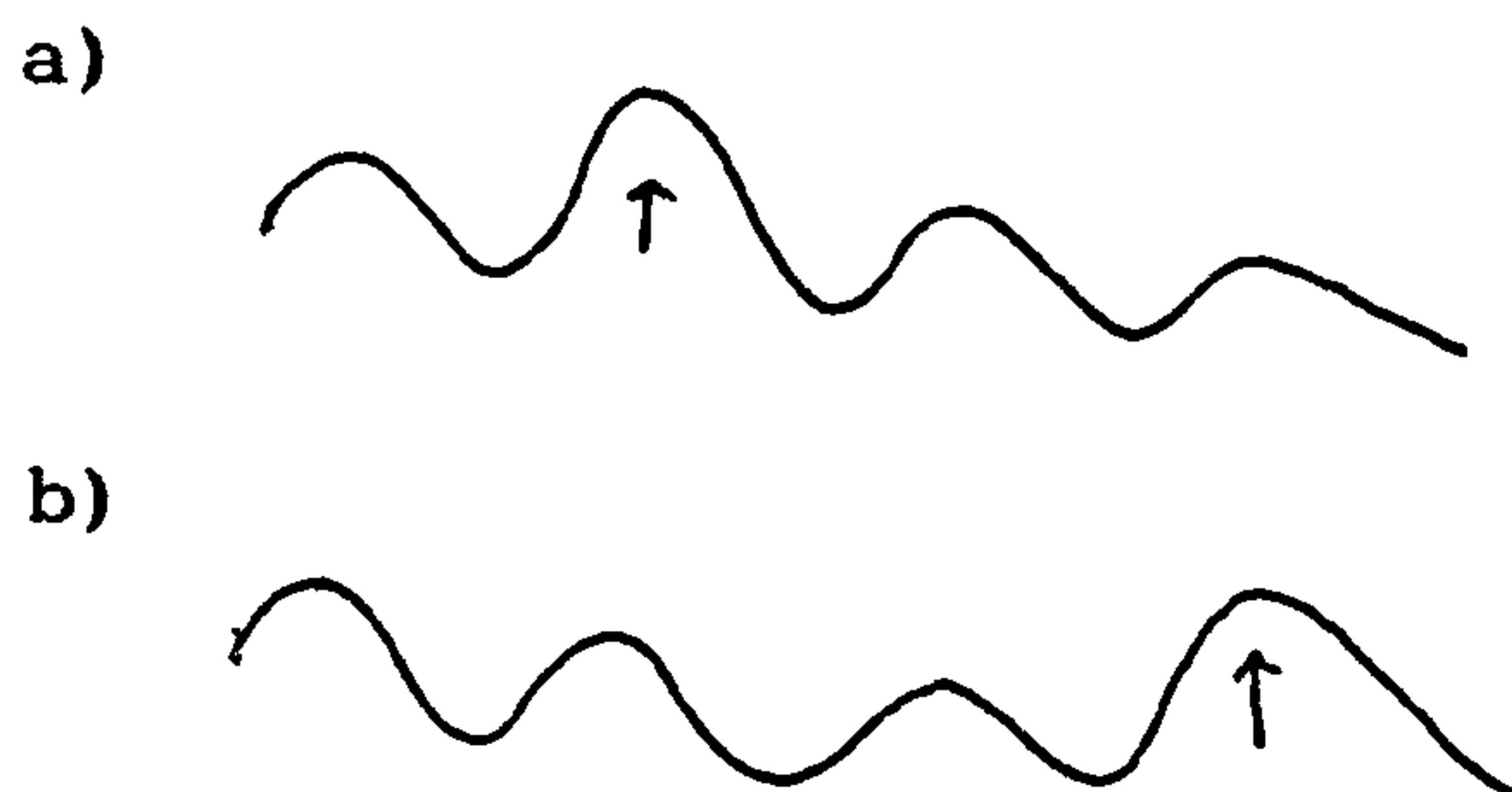
Having seen that uniformly left-branching phrases are subject to an F0 boost of some sort in the third minor phrase and are consequently neutralized with symmetrically branching phrases as in (60b) and (61b), let us consider the nature of this F0 boost.

A comparison of the F0 contours in (57) and (58) might suggest that the extra boost in (58) is due to an articulatory or analogous constraint on excessively long declining contours. This explanation appears to be descriptively adequate in view of the fact that such an unexplicable boost is observed only in uniformly left-branching phrases, which are not subject to metrical boost and are, accordingly, expected to yield a gradually declining sequence of minor phrases. However, there are at least three pieces of evidence to think that the extra F0 boost observed in uniformly left-branching phrases should be attributed to a more abstract condition on speech.

The first line of evidence concerns the fact that left-branching phrases are not subject to such a boost if they are made up of three minor phrases. According to my preliminary observation, this holds true no matter how long the component minor phrases may be, that is, no matter how long the whole phrases may become. In fact, what is relevant is the number of the minor phrases the whole F0 contour involves, and not the total phonetic length of the F0 contour. Given this, one must ask himself why then there is a crucial boundary between left-branching phrases involving three minor phrases and those made up of four minor phrases.

A second fact to note in characterizing the peculiar F0 boost in question is that the boost is added to the third minor phrase and not to the second or fourth minor phrases. If the boost is added just to break up an excessively long chain of gradually descending minor phrases, it will be possible, if not necessary, that the boost applies to the minor phrases other than the third, as illustrated in (62) below. The fact that such F0 contours do not generally surface suggests that the peculiar F0 boost is not due to an articulatory constraint or any other constraint which conditions F0 contours at a final stage of speech production.

(62) Other Possible Patterns Under Articulatory Constraint



And last, and most important, it must be remembered that it is not just the process of downstep that shows the neutralization of the uniformly left-branching structure with the symmetrically branching structure. We saw in Chapter Two that uniformly left-branching compound nouns consisting of four words tend to result in two accentual phrases with an accent phrase boundary between the second and third component words. Moreover, the experimental data discussed in Chapter Four have shown that uniformly left-branching phrases consisting of four unaccented elements break themselves into two intonational (minor) phrases, with an intonational boundary between the second and third elements, among others. What is common among these three prosodic processes in Japanese is (a) that such a modification occurs only in left-branching structures, or structures which are totally unmarked in the prosodic system of the language, (b) that no comparable phenomenon is observable in left-branching structures consisting of three elements, (c) the resultant prosodic pattern is one of symmetrical structure, with the four component elements grouped into two subgroups of two, and (d) the uniformly left-branching structure is prosodically

neutralized with the symmetrically-branching structure in each case.

Taking all these facts into consideration, I proposed in Chapter Two (section 3.4) that uniformly left-branching structures are subject to the principle of rhythmic alternation (PRA) whereby 'monotonous' sequences of linguistic elements are reorganized into two (or more) groups, yielding a fully alternating pattern in some way or other. Under this proposal, the F0 boost observed in the uniformly left-branching phrases can be defined as a 'rhythmic boost (RB)' which has the effect of converting the monotonously descending downstep contour in (63) into a more rhythmic, alternating pattern in (b), with a secondary 'beat' added on the third element:

(63) a) Basic Downstep Contour



==> b) RB Added



Supposing that this characterization of the boost in question is tenable, the next question that emerges is one of how we can describe this principle in the intonational theory of Japanese. One straightforward answer that springs to my mind is that the PRA triggers a structural reanalysis as illustrated in

(64) below at the stage where syntactic structures are mapped onto phonological (intonational) structures.

(64) Structural Reanalysis

$$[[[A\ B]\ C]\ D] \Rightarrow [[A\ B]\ [C\ D]]$$

Under this analysis, the fact that uniformly left-branching phrases show the same F0 pattern as symmetrically branching phrases can be accounted for in a straightforward way. That is, since the uniformly left-branching structure is given one and the same intonational structure as the symmetrically branching structure, phonetic realization rules (PRRs) yield identical F0 patterns for the two structures, with the third minor phrase equally raised by the principle of metrical boost. Moreover, by defining the reanalysis in (64) as a rule that applies rather generally at the syntax-phonology mapping stage, this analysis is capable of providing a plausible account of the fact that the uniformly left-branching structure is neutralized with the symmetrically branching structure in accentual and intonational phrasing processes as well as in the process of downstep.

If the analysis in terms of prosodic restructuring is fully justifiable, it then follows that 'rhythmic boost' is not rhythmic boost but is merely 'metrical boost' applied to a restructured prosodic tree.

6. MECHANICAL DECLINATION

From the discussion in the foregoing few sections, it will be understood that the tendency of F0 to decline during the course of utterances in Japanese can be defined primarily as a process which is conditioned by phonological factors and affected by metrical (syntactic) and rhythmic factors. While there seems to be no room for doubt about this claim, it must be noted that this does not preclude the possibility of Japanese involving mechanical declination as well, a declination which should be attributed to some purely phonetic factor. In this last section on Japanese intonation, I would like to show that Poser's claim on this kind of F0 declination can be largely supported.

Dataset IV contains the following four phrases which all consist of four unaccented words or simplex phrases.

(65) a) [[naomino aneno][marui yunomi]

"Naomi-Gen" "sister-Gen" "round" "teacup"
= "Naomi's sister's round teacup"

b) [[naomino [ueno aneno]] yunomi]

"Naomi-Gen" "upper-Gen" "sister-Gen" "teacup"
= "Naomi's eldest sister's teacup"

c) [naomono [[umeno irono] yunomi]]

"Naomi-Gen" "plum-Gen" "color-Gen" "teacup"
= "Naomi's plum-colored teacup"

d) [naomino [omoi [marui yunomi]]]

"Naomi-Gen" "heavy" "round" "teacup"
= "Naomi's heavy round teacup"

In terms of mora structure, these test phrases all consist of thirteen morae. Since they do not involve an accented word or phrase, they are not subject to downstep in any way. As mentioned in Chapter Four (section 6.3), these phrases are generally manifested in two or three minor phrases with a phrase boundary introduced where a right-branching structure is involved (cf. Figures 5.59-5.62). In tonal terms, in other words, these phrases yield the following structures.

- (66) a) % LHHHH % LHHH %
 b) % LHH % LHHHHHH %
 c) % LHH % LHHHHHH %
 d) % LHH % LH % LHHH %

If there is no phenomenon as characterizable as mechanical declination in Japanese, it can be predicted that the sequences of High tones should show a relatively flat F0 contour in which no noticeable downward shift in pitch is observable. To be more specific, it will be predicted that the High tones of the second (and third) minor phrases should have essentially the same F0 level as the High tones of the first minor phrases. (67) shows this schematically with the phrase in (65d).

(67)

	H H H		H H		H H H H H
L		L		L	

The actual data from my experiment, however, do not accord with these predictions at all. A glance at the F0 contours illustrated in Figures 5.59-5.62 suggests, for example, that the High-toned portion of the test phrases do not necessarily stay constant in pitch but gradually declines as the utterances progress. This is particularly in evidence in the final (second or third) minor phrase of each test phrase which declines gradually and steadily despite the fact that it is followed by no Low-toned morae.

That the High-toned morae gradually fall in pitch during the course of utterances can be seen more clearly by the comparison of the peak F0 values of neighboring minor phrases. Table 44 gives the mean peak F0 values of eleven tokens for each phrase type. ([Peak 'n'] means the peak of the n-th minor phrase. Figures in the brackets represent standard deviation).

Table 44 Summary of Data: Dataset IV

Phrase type	[Peak1]	[Peak2]	[Peak3]
(65a)	165.7 (4.73)	148.6 (4.43)	——
(65b)	159.7 (2.65)	153.9 (3.88)	——
(65c)	163.2 (3.68)	156.7 (5.12)	——
(65d)	163.0 (3.44)	153.8 (2.79)	147.3 (2.10)

Table 45 gives the result of t-test, which shows that the peak F0 differences between two successive minor phrases in Table 44 are all statistically significant.

Table 45 Summary of Statistics (All 20 df)

Phrase type	Peaks compared	t	P
(65a)	[Peak1]–[Peak2]	8.724	<.001
(65b)	[Peak1]–[Peak2]	4.085	<.001
(65c)	[Peak1]–[Peak2]	3.421	<.01
(65d)	[Peak1]–[Peak2]	6.917	<.001
	[Peak2]–[Peak3]	6.190	<.001

To summarize these experimental results, it can be said that Japanese exhibits mechanical declination by which sequences of High-toned morae gradually fall in pitch. Considered in conjunction with the discussion in the foregoing sections, it can be concluded that there are (at least)^{<43>} two factors that contribute to the tendency of F0 to decline gradually during the course of utterances in Japanese: (a) phonologically conditioned downstep and (b) mechanical declination which can be defined as a totally phonetic phenomenon.

NOTES TO CHAPTER FIVE

1. The tendency of F0 contours to decline during the course of utterances is reported on other languages too: cf. Cooper & Sorensen (1981) for English; Cohen & 't Hart (1967) for Dutch; Hombert (1974) for African languages — for a brief summary of these reports see Vaissiere (1983) and Ladd (1984). It is admittedly desirable to discuss any experimental data about Japanese in comparison with the data from these languages. In this thesis, however, I shall chiefly discuss Japanese data in relation to the organization of Japanese prosody (intonational system). I shall discuss the cross-linguistic implications of the data in another paper.

2. Poser (1984) and Beckman & Pierrehumbert (1986) employ the term 'catathesis' for what I call 'downstep' in this thesis. As I suggested in Introduction, what lies behind their choice of the terminology is the implicit claim that this intonational phenomenon in Japanese may not be equivalent to the arguably lexical phenomenon in many African languages. I will tentatively use the traditional term 'downstep' here, assuming that the two phenomena can probably be handled in the same way.

3. As I will explain shortly, Poser (1984) and Pierrehumbert & Beckman (forthcoming) both assume that the downward trend in Japanese should be attributed to more than one factor. Here, however, I tentatively classify them into the second group since they attribute the main source of the downward trend to a phonological factor, or what they call 'catathesis' (downstep).

4. Shimizu & Dantsuji (1981), for example, do not address the question of whether Japanese shows mechanical declination in natural speech. They conducted a listening experiment using synthesized nonsense stimuli to claim that native speakers of Japanese do not perceive the pitch difference putatively resulting from declination. Higurashi (1983)'s experiment analyzes very short stretches of speech in which segmental effects on pitch are not well controlled for. Moreover, her observation that pitch gradually declines in Japanese, which she refers to as 'phonetic fade,' is nothing but the phenomenon I termed 'accentual fall' in Chapter Three (section 1), or the phenomenon whereby pitch falls at a constant rate in the post-accentual position of utterances.

5. See Chapter Four (section 1) for other terms Fujisaki employs in the same sense as these.

6. Poser is correct in pointing out that Fujisaki's model "is based upon observation of F0 contours of a small number of sentences (approximately ten) whose contents have not been varied in a systematic fashion (p. 303)."



7. Since the phrases do not involve a 'major syntactic boundary,' the three accent units they yield are supposed to be realized within a single phrase component (voicing unit) in Fujisaki's theory (cf. Chapter Four, section 1).

8. For a critical sketch of Haraguchi (1977), see Note 13 below.

9. See Notes 10 and 11 below for the analyses proposed by Hayata and Shibatani respectively.

10. Hayata (1969) assumes the same accent reduction rule as McCawley. Unlike McCawley, however, Hayata does not postulate the pitch assignment rules, but assumes that pitch contours of Japanese are determined in a straightforward way by the relative strength of the phrases as defined by the accent reduction rule. This assumption is empirically unjustifiable as can be seen from the evidence in section 3 below. Left-branching and right-branching phrases consisting of three accented minor phrases, for example, are assigned, by way of the accent reduction rule, the accent patterns as in (10), which are then intonationally interpreted into the F0 contours as shown below.

Hayata's Accent Reduction Model

	[[A B] C]			[A [B C]]		
Input to ARR	1	1	1	1	1	1
1st cycle	1	2			1	2
2nd cycle	1	3	2	1	2	3
<hr/>						
Phonetic Output						

Of these two contours, the contour of the right-branching phrases is correct (cf. Figures 5.7 and 5.26) but that of the left-branching phrases is not, as can be seen from Figures 5.13 and 5.27). In other words, the phonologically conditioned lowering process chains in left-branching phrases as well as in right-branching phrases with the third minor phrase equally downstepped with respect to the second phrase in both of the two types of branching structures.

I must hasten to emphasize, however, that this defect does not lead to the argument that syntactic structure of phrases and sentences are irrelevant in characterizing downstep in Japanese. On the contrary, information on syntactic hierarchy is essential for an adequate characterization of the process as will be shown in sections 3 and 4 below. Where Hayata's model fails, then, is in the manner in which intonational structures (and hence surface F0 contours into which they are realized) are related with the syntactic structures of sentences. To be more specific, the

crucial flaw of Hayata's model lies in his assumption that surface intonational configurations are constrained by syntactic structure ('text') so heavily as to reflect the syntactic hierarchy as such.

11. Having seen the outline of McCawley's accent reduction theory, one may notice that the pitch assignment rules have a sort of 'side effect' of undoing the effect of the accent reduction rule. That is, the n-ary representation of the accent strength is converted by the pitch assignment rules into the three-level contrasts of tones (High, Mid and Low), or into the binary representation of High and Mid tones if one focuses onto the relative high-pitched portion of minor phrases. Seen in this light, it seems that the accent reduction rule can be totally dispensed with in McCawley's model. What one needs to do then will be to modify the first rule of his pitch assignment rules as in the following: "Everything in a minor phrase becomes high-pitched if it is the leftmost minor phrase in the major phrase. If it is not the leftmost minor phrase, everything in it becomes mid-pitched." Shibatani (1972) proposes his version of accent reduction model along this line.

12. Since this is an interrogative sentence, the question marker ka in the last minor phrase i'idesuka is given a high (rising) pitch at the phonetic output of speech. In this tonal (pitch) representation, I tentatively ignore this effect.

13. Haraguchi (1977) gives a similar account although he shows no experimental evidence. Haraguchi's account of downstep (his 'downdrift') correctly predicts that downstep is triggered by accent and that downstep affects the whole minor phrase following the accented phrase. Moreover, it correctly assumes that the effect of the intonational process should be defined at the stage where phonetic realizations rules implement the tonal representation. However, Haraguchi's account falls into two difficulties. First, it fails to state explicitly that unaccented words and phrases are subject to downstep just like accented words and phrases. Second, it falsely assumes that the minor phrase following an accented phrase undergoes 'total downstep' (or 'total catathesis' in Poser's terminology) whereby its initial lowering is totally eliminated. As was shown in Chapter Four (section 4), this type of downstep can occur in Japanese under certain conditions, but it is not as common as Haraguchi assumes. In fact, my data have shown not a single example of total downstep in some 200 utterances consisting of two minor phrases.

14. Pierrehumbert & Beckman (forthcoming) suggest that there is a third source, which they call 'final lowering,' that contributes to the downward trend of pitch in Japanese. In the absence of sufficient experimental evidence, I cannot give a proper comment on this claim and will not discuss this issue in this thesis.

15. Poser analyzes what I characterize as right-branching phrases in this thesis: e.g. the two phrases in Table 2. Failure to analyze left-branching phrases, the more common phrase type than the right-branching counterpart in Japanese, leads Poser to claim mistakenly that total downstep does not occur in Japanese (cf. Chapter Four).

16. As suggested in Chapter 4 (section 1), this criticism applies not only to Poser but to most other researchers on Japanese declination, including McCawley (1968), Fujisaki and Pierrehumbert & Beckman.

17. As I suggested in Chapter Four (section 6), sequences of two words and phrases can be combined to form one minor phrase (cf. Figure 5.63). In such cases, the F0 level at the boundary between the two components was tentatively identified as the onset of the second component (that is, [Valley2]), and the highest point within the second component was interpreted as its peak.

18. When the first component is unaccented, it is often intonationally amalgamated with the second component (cf. Figure 5.64). In such cases, the boundary between the two component words, which is generally the highest point of the second component, was tentatively identified as the onset (that is [Valley2]) and peak (that is, [Peak2]).

19. The effect of accentual boost on the first minor phrase is (more or less) statistically significant as shown in the following table (df=16):

Parameter	Accent type	Mean (Hz)	SD	T	P
[Valley1]	<1a> [+A,+A,+A]	165.0	6.89	2.230	<.05
	<1b> [-A,+A,+A]	158.4	4.75		
[Peak1]	<1a> [+A,+A,+A]	181.5	6.65	1.941	<.10
	<1b> [-A,+A,+A]	176.2	4.37		

20. The effect of accentual boost is statistically significant (df=17):

Parameter	Accent type	Mean (Hz)	SD	T	P
[Valley2]	<1a> [+A,+A,+A]	144.4	5.78	3.386	<.01
	<1c> [+A,-A,+A]	135.8	5.02		
[Peak2]	<1a> [+A,+A,+A]	168.3	7.07	3.433	<.01
	<1c> [+A,-A,+A]	158.0	5.53		

21. It may be necessary to add in regard to <1a> that the effect of the first downstep may be obscured as the utterance progresses. This is seen from Figure 5.11, where one finds that [Peak3] of <1a>, the peak of its second downstepped minor phrase, is just as high as [Peak3] of <1b>, in which downstep has taken place only once. A similar observation can be made about left-branching phrases of the same accentual structure, as can be seen from Figure 5.17.

22. Figure 5.17 shows that the first component has a higher pitch when it is accented (i.e. in <2/3a>) than when it is unaccented (i.e. in <2/3b>). This effect of accentual boost is statistically significant (df=39):

Parameter	Accent type	Mean(Hz)	SD	T	P
[Valley1]	<2/3a> [+A,+A,+A]	166.7	6.34	3.179	<.01
	<2/3b> [-A,+A,+A]	161.2	4.10		
[Peak1]	<2/3a> [+A,+A,+A]	187.6	3.33	9.455	<.001
	<2/3a> [-A,+A,+A]	177.2	3.64		

23. Just as in the sequences of two words or phrase (see Note 17 above), the first two component words of these three-component test phrases were often fused to form what looks like a single minor phrase (cf. Chapter Four, section 6). In such cases, the F0 level at the boundary between the two components was measured as the onset F0 value of the second component, that is, [Valley2], while the highest level within the second component was measured as its peak value ([Peak2]).

24. Again, the effect of accentual boost realizes the second component word higher when it is accented (i.e. in <2/3a>) than when it is unaccented (i.e. in <2/3c>). This difference is statistically significant (df=37):

Parameter	Accent type	Mean(Hz)	SD	T	P
[Valley2]	<2/3a>[+A,+A,+A]	147.8	8.93	5.002	<.001
	<2/3c>[+A,-A,+A]	136.2	4.39		
[Peak2]	<2/3a>[+A,+A,+A]	162.7	4.84	6.723	<.001
	<2/3c>[+A,-A,+A]	150.8	6.20		

25. See Note 21 above.

26. This compares with the fact that the intonational process of accentual fall is not sensitive to a minor phrase boundary (cf. Chapter Three, section 1). This suggests that there are two types of intonational phenomena in Japanese, those which are defined in reference to a minor phrase boundary (e.g. downstep and accentual and pre-accentual boost) and those for which such boundary information is irrelevant (e.g. accentual fall).

27. The difference shown by the two types of phrases in regard to [Peak2-Valley2] is due to the effect of accentual boost. That is, the second minor phrase shows a greater degree of F0 rise at its onset if it is accented than if it is unaccented.

28. See Note 27.

29. The greatest difference with respect to [Peak1] is found between (25a) and (25d) in Table 21 and between (27a) and (27e) in Table 23. In both cases the difference is statistically significant:

(25a) vs. (25d): ($p(T=2.772, df=20) < .05$)

(27a) vs. (27e): ($p(T=2.421, df=20) < .05$)

30. In contrast to Table 21 and Table 23, [Peak1] remains more or less constant in Table 22. The greatest difference observed is that between (26c) and (26d) but it is not statistically significant: ($p(T=1.728, df=20) > .05$).

31. Here, again, a substantial difference is observed both in Table 21 and Table 23. The greatest difference in Table 21 is observed between (25d) and (25e) and is significant: ($p(T=4.159, df=20) < .001$). The greatest difference in Table 23 is found between (27a) and (27e) and is also significant ($p(T=4.762, df=20) < .001$). In Table 22, by contrast, no significant difference is observed — The greatest difference is observed between (26c) and (26d) but is not significant: ($p(T=1.069, df=20) > .20$). This is because the four test phrases in Table 22 do not differ from each other in the tonal structure of the first component and is hence free from the effect which tonal differences in the first component could otherwise exert on the following component.

32. (25d) does not seem to conform to the general tendency I am suggesting, by showing a higher [Peak2] than expected. This is probably due to the tonal effect on the peak level. That is, (25d) involves three post-accentual Low-toned morae in its second component while other test phrases involve one or two Low-toned morae in the same position. As minor phrases generally have a higher peak level as they involve more Low-toned morae in the post-accentual position, it can be assumed that this tonal difference leads the second minor phrase in (25d) to have a higher peak level than expected.

33. There are many more pseudo-minimal pairs of phrases like this. E.g.

(i) [na'okono [me'nno eri'maki]]

"Naoko-Gen" "cotton-Gen" "muffler"
= "Naoko's cotton muffler"

[[na'okono me'ino] eri'maki]

"Naoko-Gen" "niece-Gen" "muffler"
= "Naoko's niece's muffler"

(ii) [mazusi'i [nangokuno hito'bito]]

"poor" "south country-Gen" "people"
= "poor people in tropical countries"

[[mazusi'i kunino] hito'bito]

"poor" "country-Gen" "people"
= "people in poor countries"

(iii) [o'okina [nookonno o'obaa]]

"big" "dark-blue-Gen" "overcoat"
= "a big dark-blue overcoat"

[[o'okina nooenno] o'onaa]

"big" "farm-Gen" "owner"
= "owner of a big farm"

34. The only possible exception to this is those F0 contours showing total downstep, whereby initial lowering is totally eliminated in a downstepped minor phrase (cf. Chapter Four, section 4).

35. Having seen in section 2.2 above that tonal differences of component words can cause a slight but statistically significant effect on the configuration of downstep, one may suspect, quite naturally, that the differences in Table 28 may be due to a difference in the tonal structure of the component words constituting the two types of phrases. As illustrated in the table below, the two types of constructions analyzed show slight differences in the values of 'PALM' and 'PALM-within' with respect to the first two component words.

Table 2 Tonal Differences Between <1a> and <2/3a>

	PALM	PALM-within
<1a>	2.00	1.75
<2/3a>	2.11	1.78

However, these tonal differences cannot reasonably be related with the outcome in Table 28. The tonal differences are not accompanied by differences in [Valley2] or [P(eak)1-V(alley)2]. Since the difference in the value of PALM shows itself most clearly in the degree of accentual fall and the resultant valley level, the lack of a significant difference between the two branching structures in these two parameters provides evidence against the tonal explanation.

36. In addition to the two implications discussed here, the notion of metrical boost implies that phrase-initial F0 rise characterizable as the initial lowering of the phrase is partly attributable to the effect of metrical boost. Refer back to Chapter Four (section 5) for a detailed discussion.

37. These four test phrases slightly differ in tonal structure. The following table illustrates this difference in regard to 'PALM-within' for each component.

Phrase	1st comp.	2nd comp.	3rd comp.	4th comp.
(47a)	3 (morae)	2	1	2
(47b)	3	3	1	2
(47c)	3	2	3	2
(47d)	1	3	2	2

38. Table 33 shows that (47d) has a strikingly lower peak for the first minor phrase than the others, with the difference being statistically significant, as can be seen from the following table (All 22 df):

Phrases compared	T	P
(47d) vs. (47a)	3.591	<.01
(47b)	4.896	<.001
(47c)	4.600	<.001

The significantly lower [Peak1] in (47d) may be attributed to the tonal difference between (47d) and the other four test phrases. As the tonal representation in (47) show (cf. Note 37), (47d) has only one post-accentual Low-toned mora in the first minor phrase whereas (47a)-(47c) have three morae in this position. Since the peak of minor phrases tend to rise as they contain a larger number of post-accentual Low-toned morae ('PALM'), the tonal difference between (47a)-(47c) and (47d) may well lead to the former three phrases to have a higher [Peak1] than (47d). This account is supported, at least in part, by the fact that (47d) shows a markedly smaller value than the other test phrases for the degree of accentual fall, which generally reflect tonal differences in a straightforward way (cf. Chapter Three, section 1).

[Accentual Fall: Peak1-Valley]

Phrase	Mean(Hz)	SD
(47a)	58.2	3.28
(47b)	62.4	5.28
(47c)	62.1	4.10
(47d)	39.9	8.27

Phrases compared	T	P
(47d) vs (47a)	6.703	<.001
(47b)	7.550	<.001
(47c)	7.869	<.001

39. The data obtained for (47d) may admit of another interpretation. Since [Peak2] in (47d) is the same as [Peak1] in the other three phrases, as can be seen from Table 33, it may be possible to suppose that this particular kind of hierarchical configuration undergoes a kind of restructuring whereby [Peak1] and [Peak2] are turned into a kind of 'prehead' and the starting point of downstep respectively. I do not prefer this interpretation since, according to my intuition, downstep is applicable to the first two minor phrases in (47d) even though the second phrase may be realized at a higher level than the first at the phonetic output. That is, the second phrase, yu'mikoga, appears to receive a lower pitch (i.e. undergoes downstep) when following the accented phrase ao'i than when following an unaccented phrase (e.g. akai). See the discussion in section 4 below for the evidence that a downstepped minor phrase can be phonetically realized at a lower level than the phrase which has triggered the lowering.

40. See Note 37 above.

41. Besides the test phrases given in (60), Dataset IX includes the following uniformly left-branching phrases:

[[[na'okono ni'isanno] eri'makino] iromo'yoo]

"Naoko-Gen" "brother-Gen" "muffler-Gen" "design"
= "design of Naoko's brother's muffler"

[[[nau'i mi'narino] onna'nokono] i'yaringu]

"fashionable" "appearance-Gen" "girl-Gen" "earring"
= "the earring worn by the trendy-dressed girl"

42. I can provide no satisfactory reason for this difference. One possibility may be that the segmental effect of [r] on the F0 of the neighboring vowels, i.e. a local F0 dip (erimaki). I leave this an open question.

43. See Note 14 above.

LIST OF FIGURES

Figure 5.1. Typical F0 contour of the phrase uma'i nomi'mono "tasty drink," which consists of two accented words.

Figure 5.2. Typical F0 contour of the phrase amai nomi'mono "sweet drink," which consists of an unaccented word and an accented word.

Figure 5.3. Comparison of the schematized F0 contours of the two phrases illustrated in Figures 5.1 (solid line) and 5.2 (dotted line).

Figure 5.4. Typical F0 contour of the phrase uma'i yamaimo "tasty yam (potato)," which involves the sequence of an accented word followed by an unaccented word.

Figure 5.5. Typical F0 contour of the phrase amai yamaimo "sweet yam," which consists of two unaccented words.

Figure 5.6. Comparison of the schematized F0 contours of the two phrases illustrated in Figures 5.4 (solid line) and 5.5 (dotted line).

Figures 5.7–5.10 Typical F0 contours of right-branching phrases consisting of three words (or simplex phrases): Dataset VII

Figure 5.7. <1a> [+A,+A,+A] kowa'i me'no ya'mai
"fearful eye disease"

Figure 5.8. <1b> [-A,+A,+A] kiiroi me'nno ori'mono
"yellow cotton fabrics"

Figure 5.9. <1c> [+A,-A,+A] ao'i momenno ori'mono
"blue cotton fabrics"

Figure 5.10. <1d> [-A,-A,+A] amai marui me'ron
"sweet round melon"

Figure 5.11 Comparison of the schematized F0 contours of the two types of phrases as illustrated in Figures 5.7 (solid line) and 5.8 (dotted line).

Figure 5.12 Comparison of the schematized F0 contours of the two types of phrases as illustrated in Figures 5.7 (solid line) and 5.9 (dotted line).

Figures 5.13–5.16. Typical F0 contours of left-branching phrases consisting of three words (or simplex phrases): Dataset VII

Figure 5.13. <2/3a> [+A,+A,+A] a'warena mi'narino o'yako
"poorly dressed family"

Figure 5.14. <2/3b> [-A,+A,+A] na'okono ne'esanno i'varingu
"Naoko's sister's earring"

Figure 5.15. <2/3c> [+A,-A,+A] nau'i moyoono eri'maki
"a muffler with a trendy design"

Figure 5.16. <2/3d> [-A,-A,+A] amai neirono o'ngaku
"sweet-tuned music"

Figure 5.17. Comparison of the schematized F0 contours of the two types of phrases as illustrated in Figures 5.13 (solid line) and 5.14 (dotted line).

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Figures 5.19–5.20. Relation between the terminal F0 point of accentual fall, plotted on the x-axis, and the degree of the immediately following F0 rise (initial lowering), plotted on the y-axis: Dataset V.

Figure 5.19. In the sequence of two accented minor phrases

Figure 5.20. In the sequence of an accented minor phrase followed by an unaccented phrase.

Figures 5.21–5.22. Relation between the degree of accentual fall, plotted on the x-axis, and the degree of the immediately following F0 rise (initial lowering), plotted on the y-axis: Dataset V.

Figure 5.21. In the sequence of two accented minor phrases.

Figure 5.22. In the sequence of an accented phrase followed by an unaccented phrase.

Figure 5.23. Effect of the tonal structure of a minor phrase on its peak: i.e. Relation between the number of post-accentual Low-toned morae within a minor phrase ('PALM-within'), plotted on the x-axis, and the F0 peak of the phrase, plotted on the y-axis: Dataset V.

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Figure 5.24. In the sequence of two accented minor phrases.

Figure 5.25. In the sequence of one accented minor phrase followed by an unaccented phrase.

Figures 5.26-5.27. Typical F0 contours of the two types of phrases from Dataset VIII: [+A,+A,+A]

Figure 5.26. The right-branching phrase ao'i o'okina me'ron "an unripe big melon"

Figure 5.27. The left-branching phrase ao'i me'ronno nio'i "smell of an unripe melon"

Figure 5.28. Comparison of the schematized F0 contours of the two phrases illustrated in Figures 5.26 (solid line) and 5.27 (dotted line).

Figure 5.29. Comparison of the two types of phrases illustrated in Figures 5.26 (circles) and 5.27 (triangles) : Value of F0 peak of the second minor phrase as a function of the value of F0 peak of the first minor phrase.

Figures 5.30-5.31. Typical F0 contours of the two types of syntactic phrases from Dataset VIII: [+A,-A,+A]

Figure 5.30. The right-branching phrase o'okina omoi me'ron "a big heavy melon"

Figure 5.31. The left-branching phrase o'okina mimino o'okami "a wolf with big ears"

Figures 5.32-5.33. Typical F0 contours of the two types of syntactic phrases from Dataset VIII: [+A,-A,+A]

Figure 5.32. The right-branching phrase na'rano yumeina ryo'ori "famous dishes of Nara."

Figure 5.33. The left-branching phrase na'rano omivano eha'gaki "the picture-card of a shrine in Nara."

Figures 5.34-5.35. Typical F0 contour of the two types of syntactic phrases from Dataset VIII: [+A,-A,-A]

Figure 5.34. The right-branching phrase na'rano yurumeina omiya "a famous shrine in Nara."

Figure 5.35. The left-branching phrase na'rano omiyano omamori "the amulet of a shrine in Nara."

Figure 5.36. Comparison of the schematized F0 contours of the two phrases illustrated in Figures 5.30 and 5.31: solid and dotted lines represent the contours of the right-branching and left-branching phrases respectively.

Figure 5.37. Comparison of the schematized F0 contours of the two phrases illustrated in Figures 5.32 and 5.33: solid and dotted lines represent the contours of the right-branching and left-branching phrases respectively.

Figure 5.38. Comparison of the schematized F0 contours of the two phrases illustrated in Figures 5.34 and 5.35: solid and dotted lines represent the contours of the right-branching and left-branching phrases respectively.

Figure 5.39. Comparison of the schematized F0 contours of the two types of phrases as illustrated in Figures 5.7 and 5.13 (Dataset VII): solid and dotted lines represent the F0 contours of the right-branching and left-branching phrases respectively, on the basis of the mean peak and valley F0 values.

Figure 5.40. Comparison of the schematized F0 contours of the two types of left-branching phrases in Dataset VII: solid and dotted lines represent the F0 contours of the loosely-bound and tightly-bound left-branching phrases respectively, on the basis of the mean peak and valley F0 values.

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Figures 5.42-5.44. Typical F0 contours of the three types of phrases in Dataset IX, all consisting of four accented words (or simplex phrases).

Figure 5.42. [[A B][C D]] na'okoga a'nda u'uruno eri'maki "the woolen muffler Naoko knit"

Figure 5.43. [A [B [C D]]] yu'mikono o'okina ao'i eri'maki "Yumiko's big blue muffler"

Figure 5.44. [[[A B] C] D] ma'rikoga no'nda wa'inno nio'i
"the smell of the wine Mariko drank"

Figure 5.45. Schematized F0 contour of the phrase type as illustrated in Figure 5.42, on the basis of the averaged peak and valley F0 values.

Figure 5.46. Schematized F0 contour of the phrase type as illustrated in Figure 5.43, on the basis of the averaged peak and valley F0 values.

Figure 5.47. Comparison of the schematized F0 contours in Figures 5.45 (solid line) and 5.46 (dotted line).

Figures 5.48–5.53 Typical F0 contours of the six phrases in Dataset X.

Figure 5.48. [[na'okono a'nino][ao'i eri'maki]]
"Naoko's brother's blue muffler"

Figure 5.49. [ma'rikono [o'okina [ao'i eri'maki]]]
"Mariko's big blue muffler"

Figure 5.50. [[a'yakono [me'nno eri'makino]] iromo'yoo]
"design of Ayako's cotton muffler"

Figure 5.51. [ao'i [[yu'mikoga a'nda] eri'maki]]
"blue muffler which Yumiko knit"

Figure 5.52. [[na'okono aneno][ao'i eri'maki]]
"Naoko's sister's blue muffler"

Figure 5.53. [[[a'ikoga a'nda] eri'makino] iromo'yoo]
"design of the muffler Aiko knit"

Figure 5.54. Comparison of the schematized F0 contours of the two phrases illustrated in Figure 5.48 (solid line) and Figure 5.49 (dotted line).

Figure 5.55. Comparison of the schematized F0 contours of the two phrases illustrated in Figure 5.50 (solid line) and Figure 5.51 (dotted line).

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Figure 5.57. Comparison of the schematized F0 contours of the two types of phrases from Dataset IX, as illustrated in Figure 5.42 (solid line) and Figure 5.44 (dotted line).

Figure 5.58. Comparison of the schematized F0 contours of the two phrases from Dataset X, illustrated in Figure 5.48 (solid line) and Figure 5.53 (dotted line).

Figures 5.59–5.62. Typical F0 contours of the four phrases from Dataset IV, all consisting of four unaccented words (or simplex phrases).

Figure 5.59. [[naomino aneno][marui yunomi]]
"Naomi's sister's round teacup"

Figure 5.60. [[naomino [ueno aneno]] yunomi]
"Naomi's eldest sister's teacup"

Figure 5.61. [naomino [[umeno irono] yunomi]]
"Naomi's plum-colored teacup"

Figure 5.62 [naomino [omoi [marui yumomo]]]
"Naomi's heavy round teacup"

Figure 5.63. Typical F0 contour of the phrase amai me'ron "sweet melon" where two components are intonationally fused into a single minor phrase.

Figure 5.64. Typical F0 contour of the phrase amai oimo "sweet potato" where two components are intonationally fused into a single minor phrase.

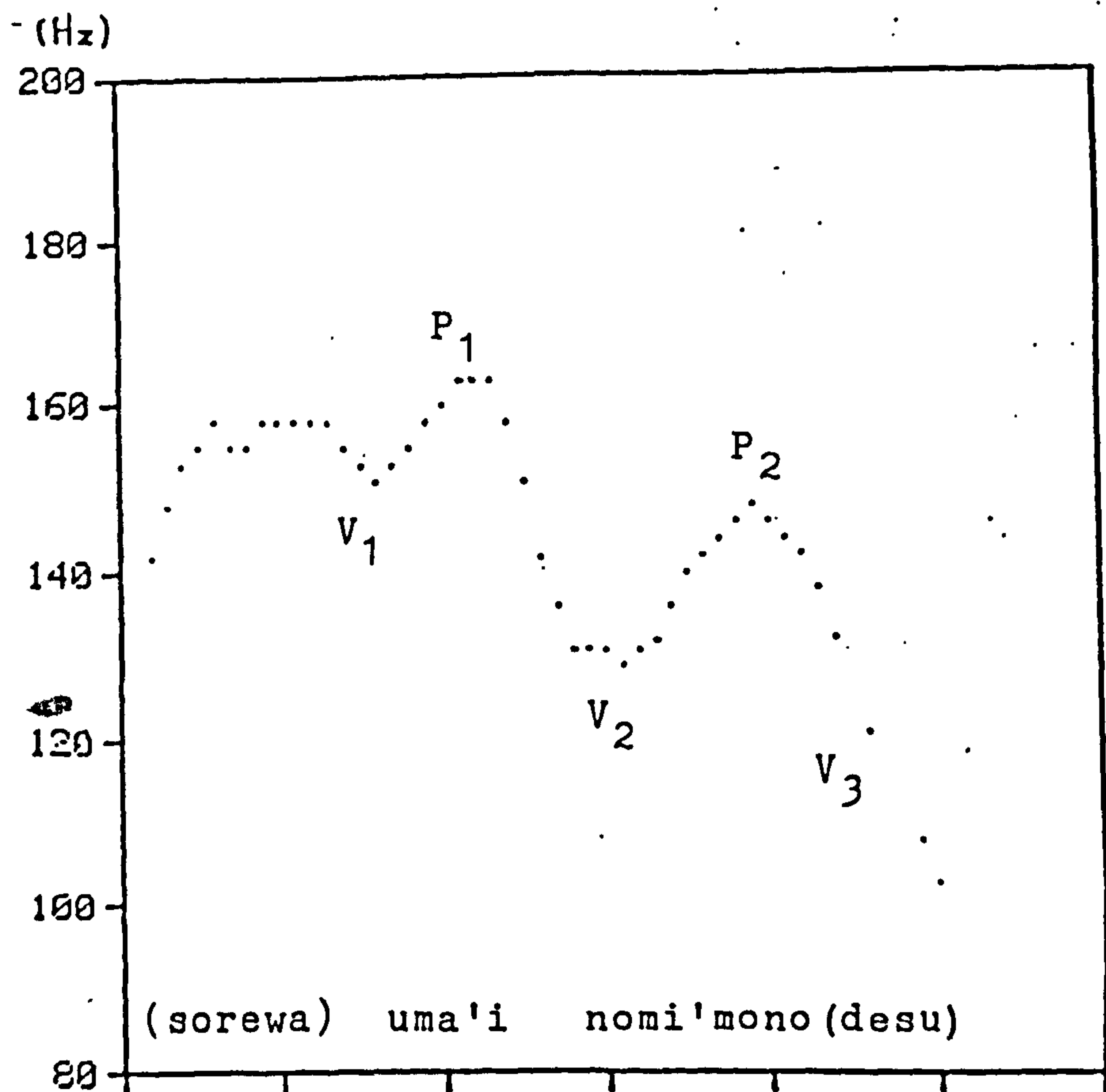


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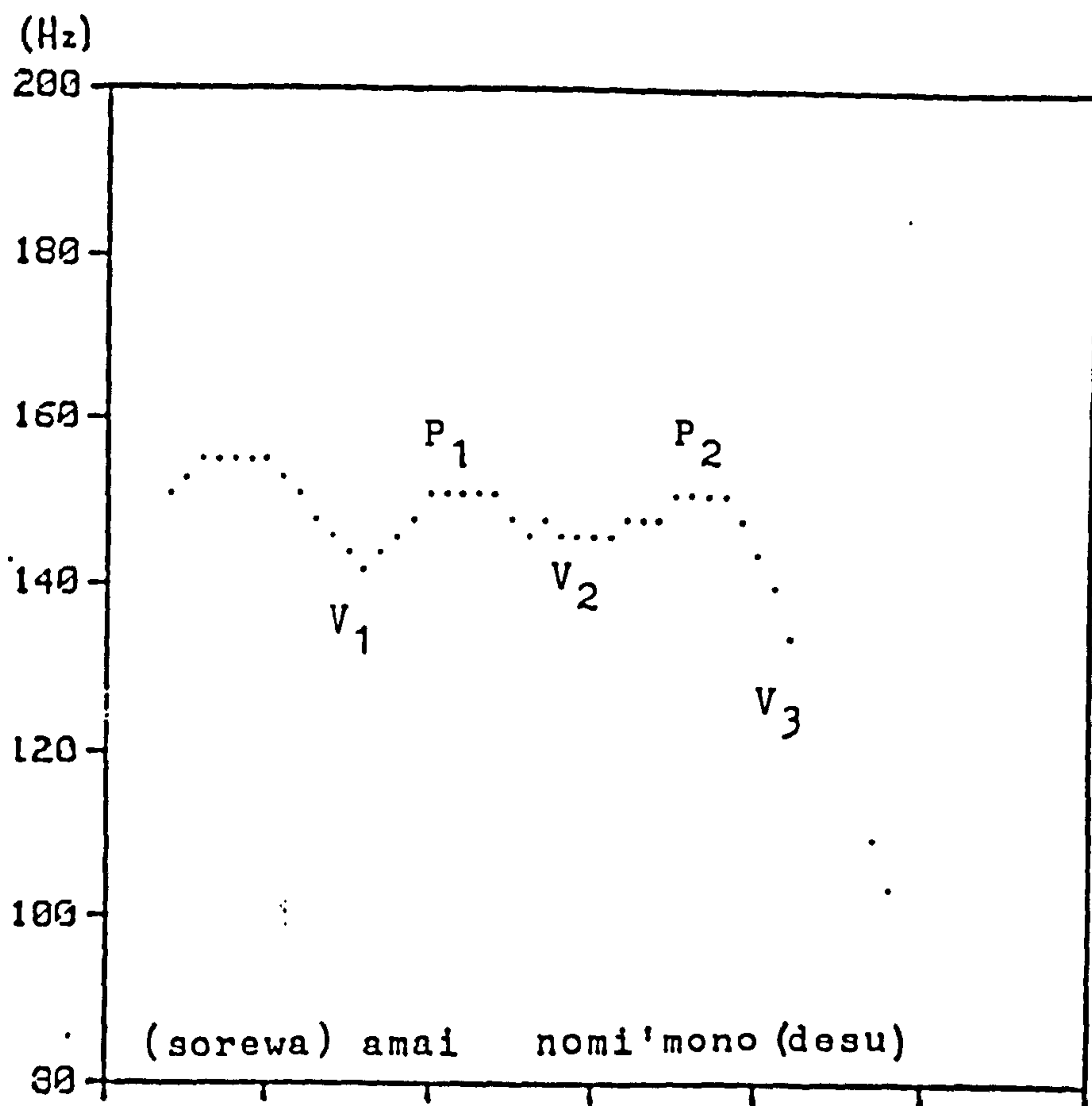


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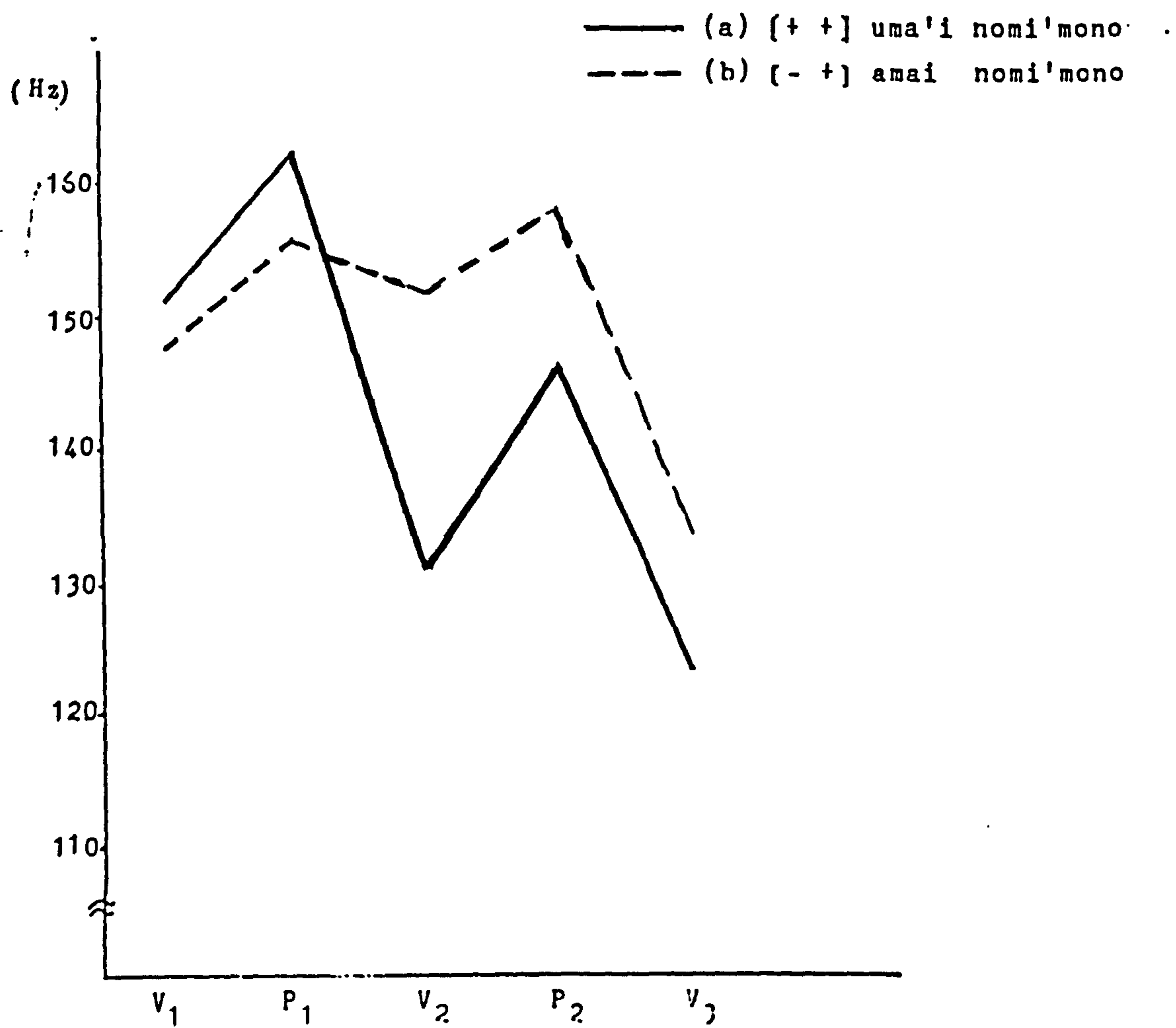


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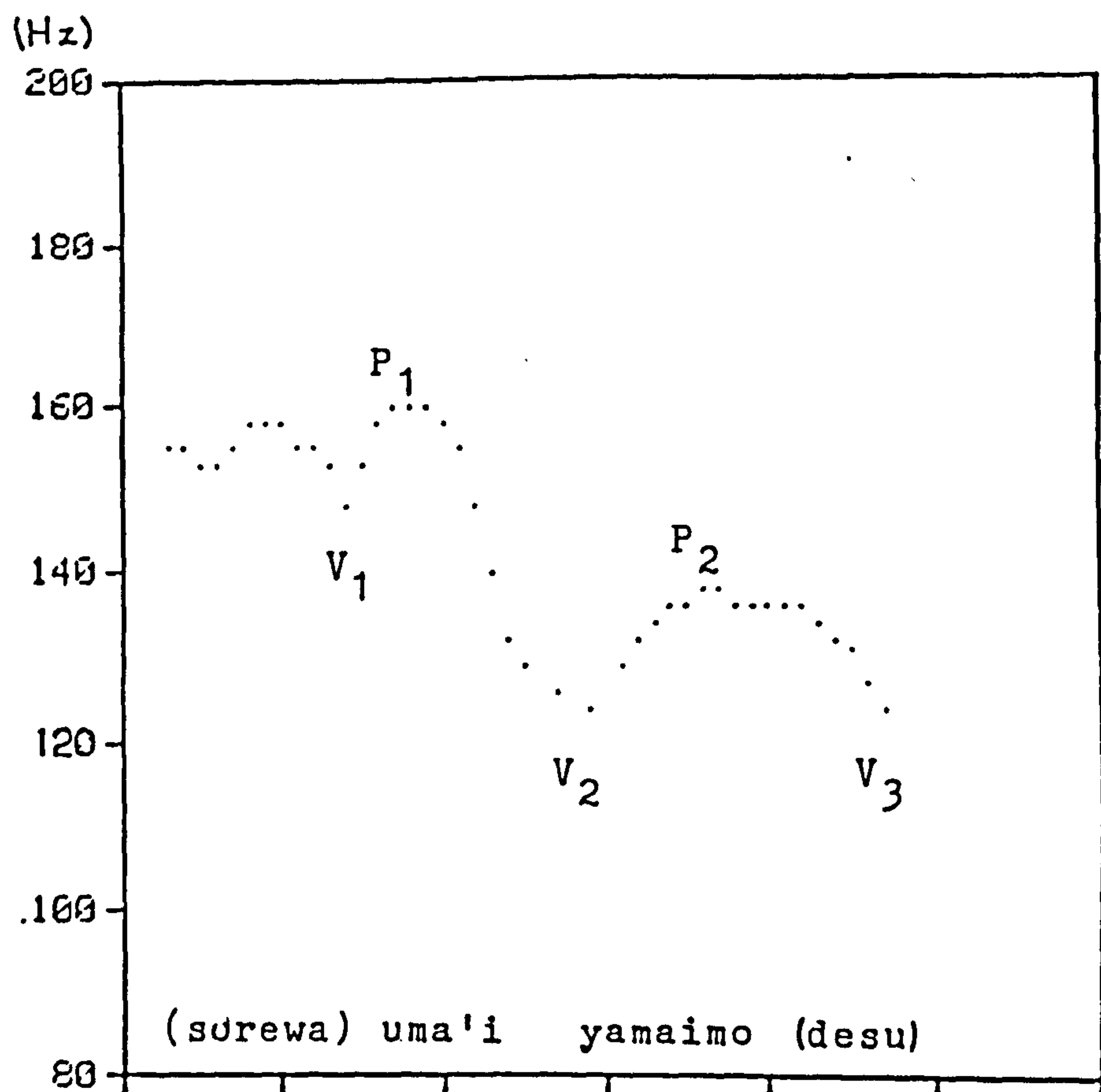


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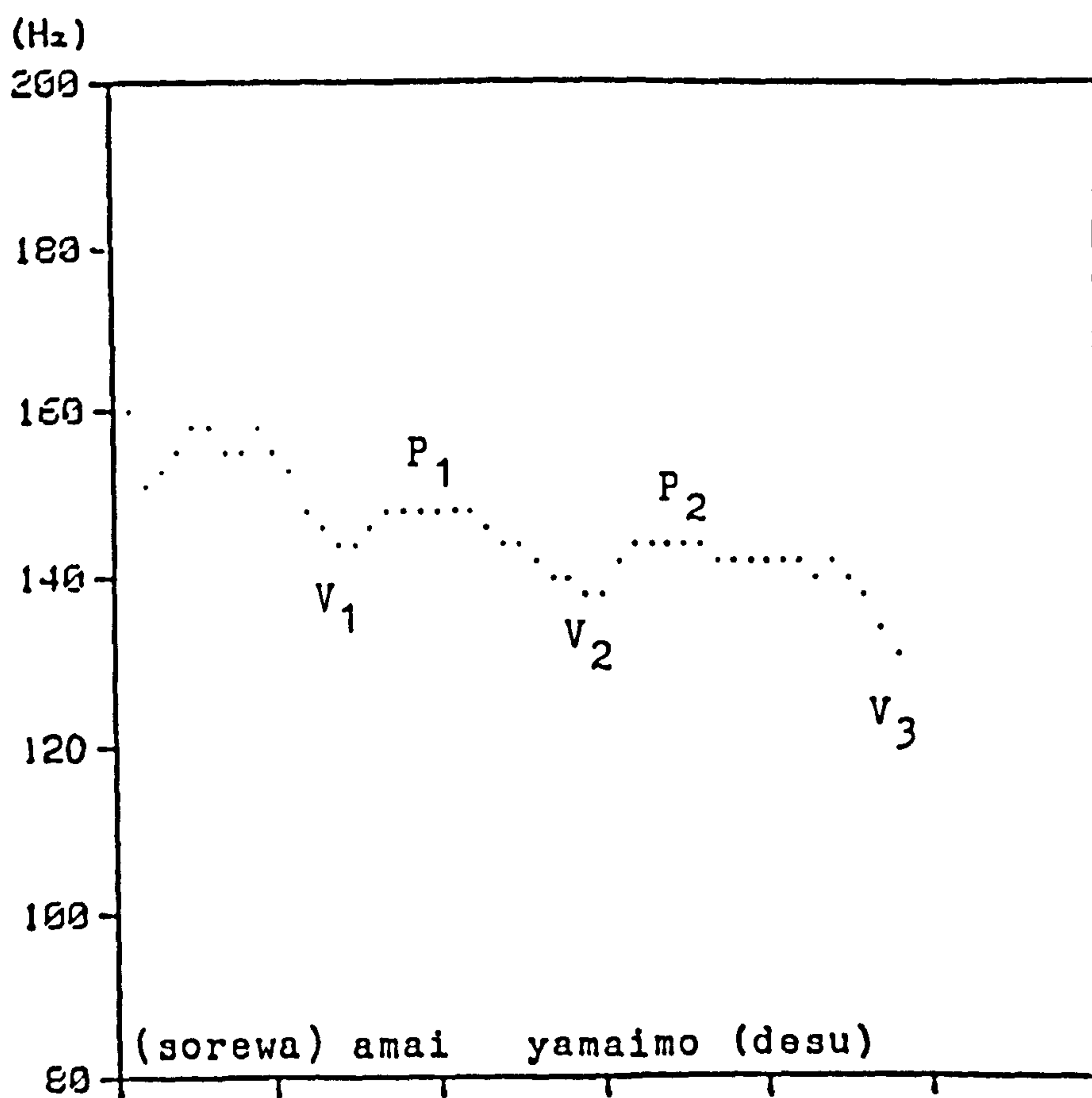


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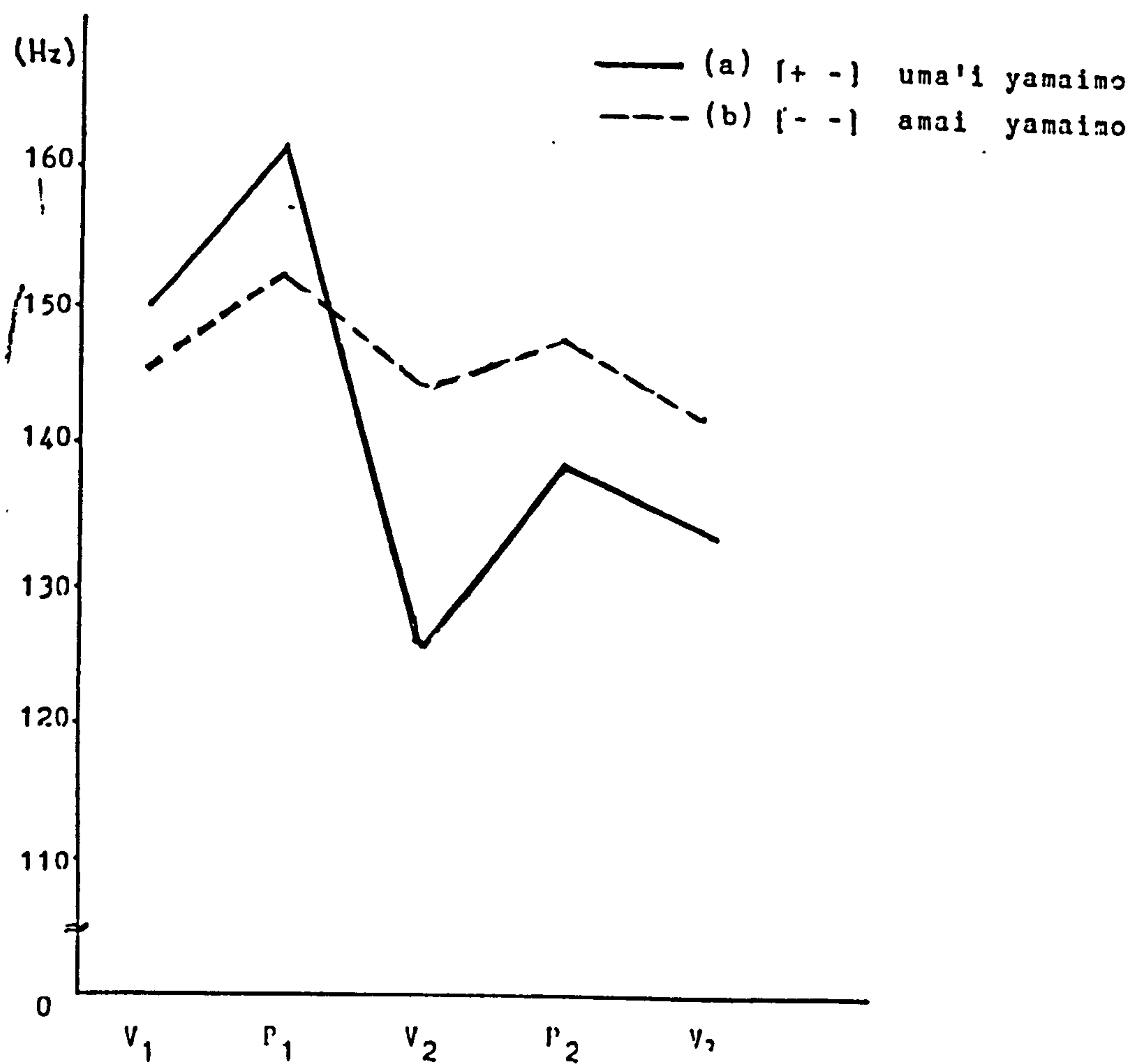


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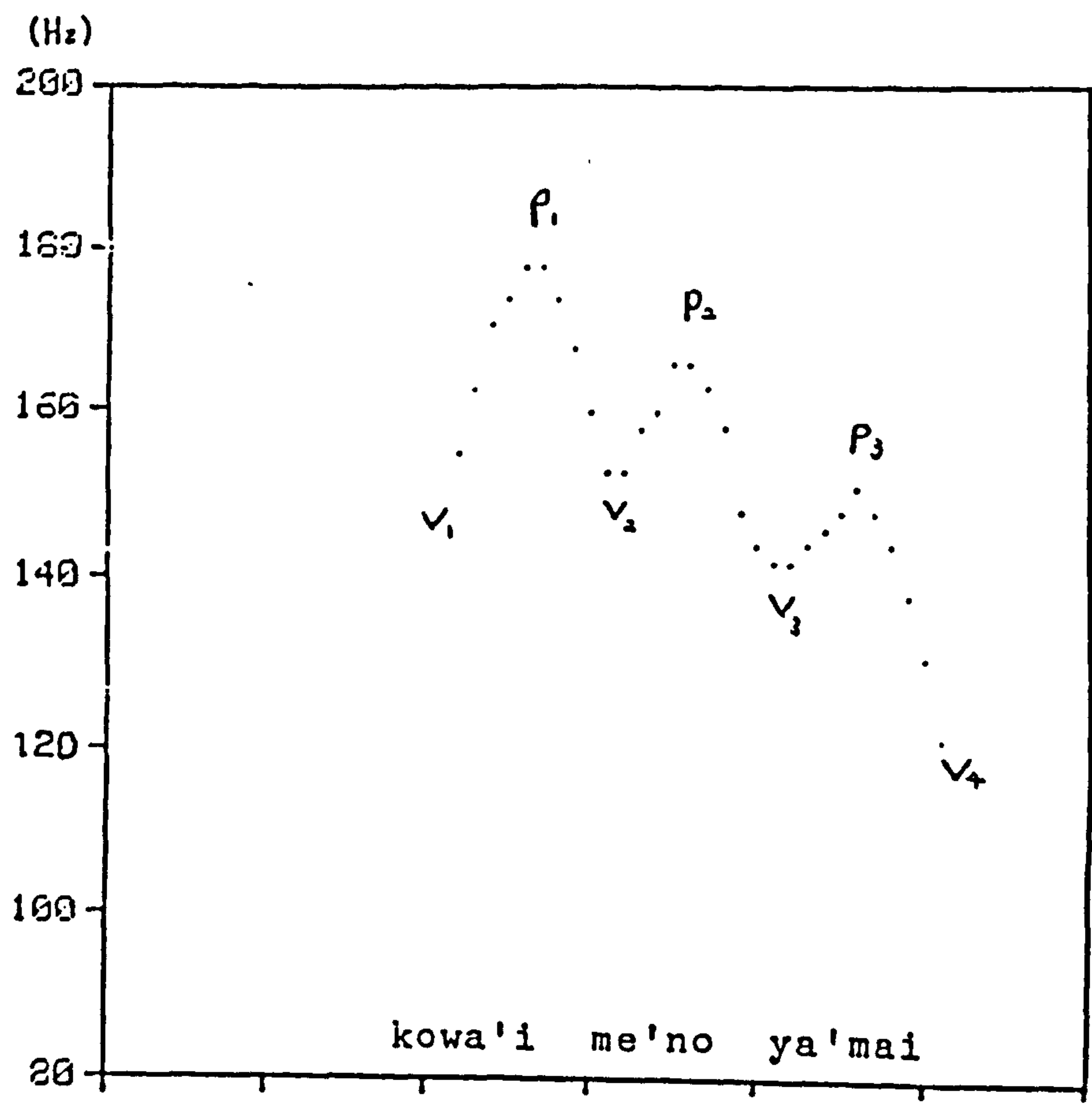


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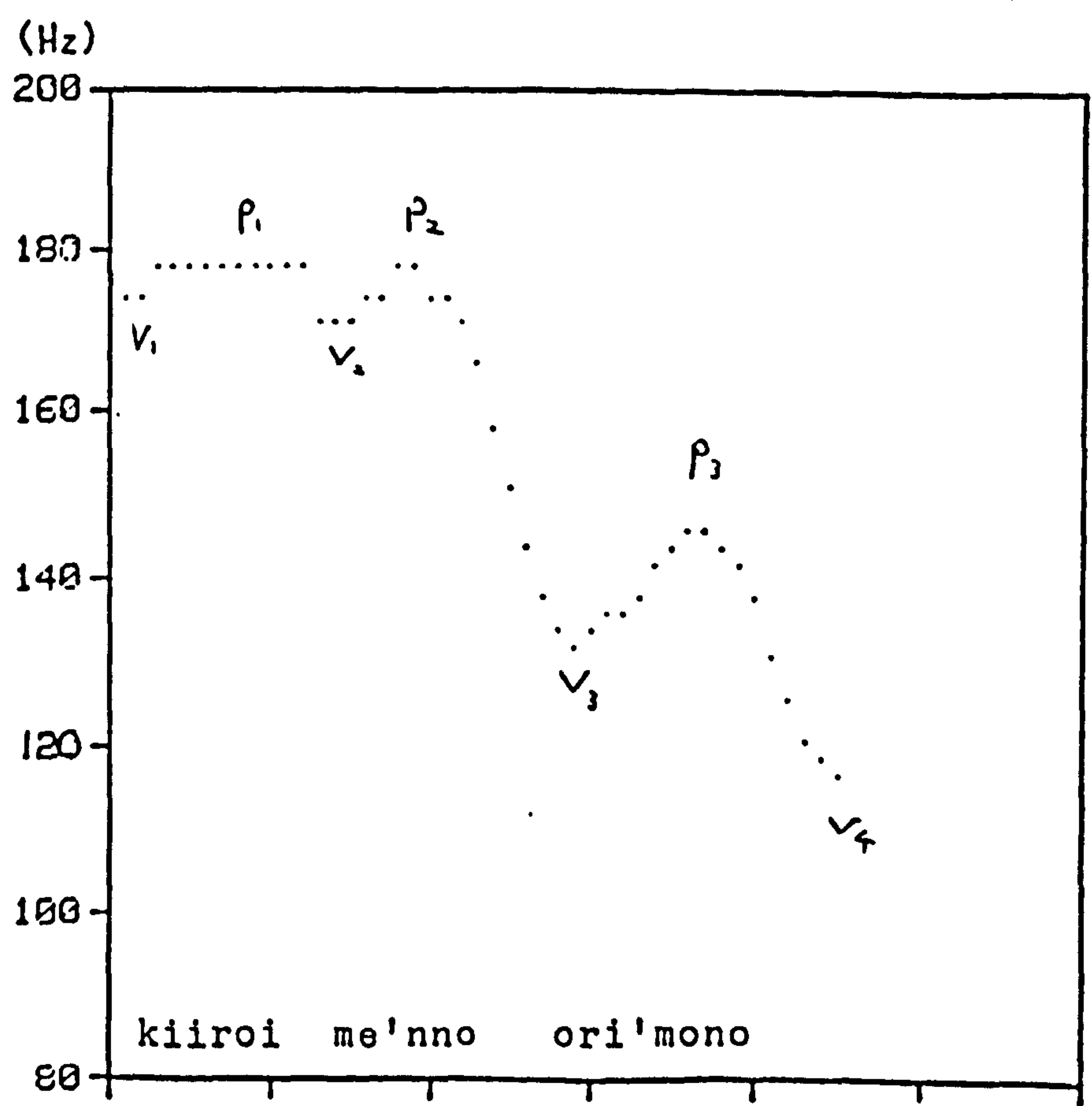


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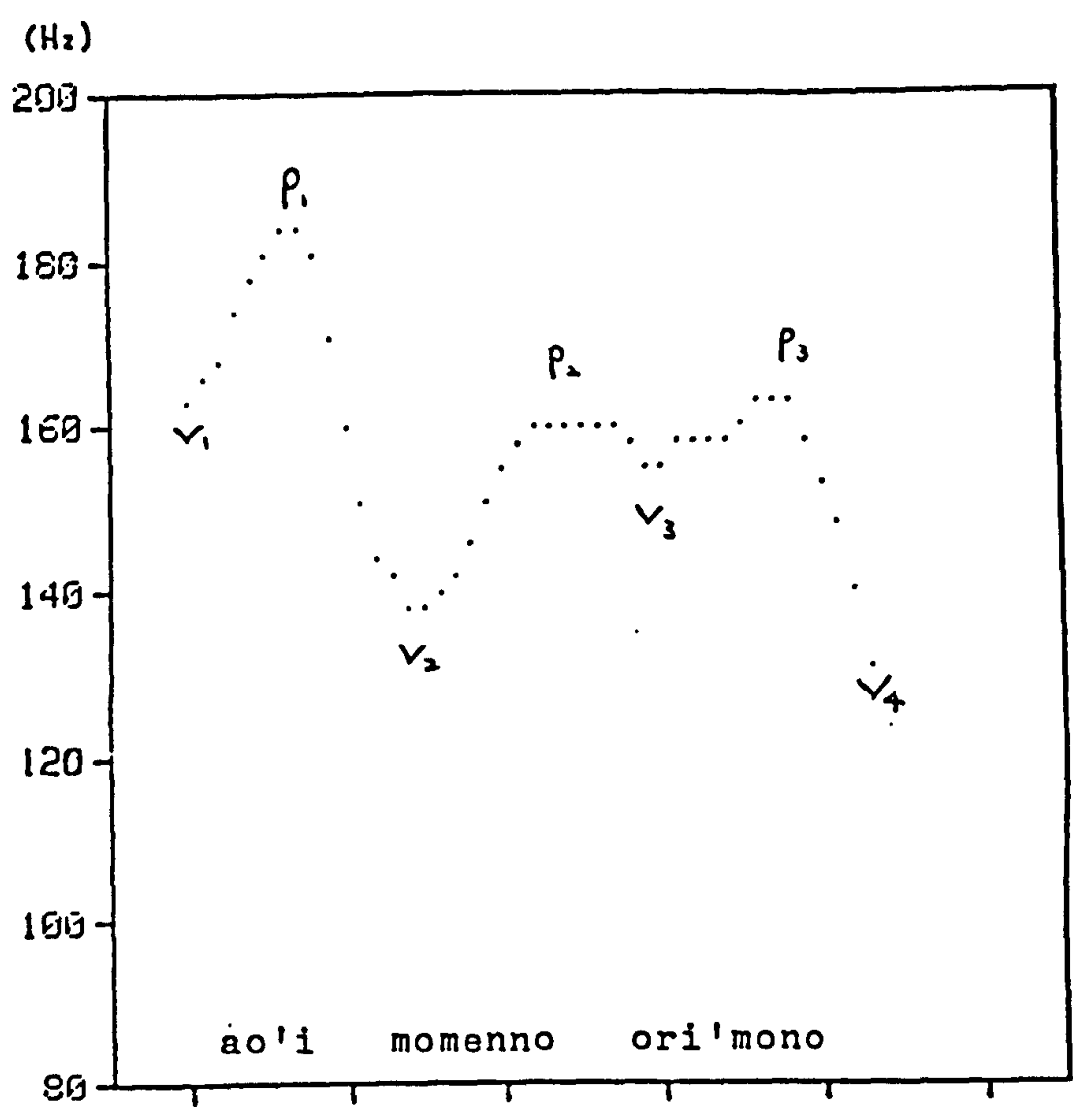


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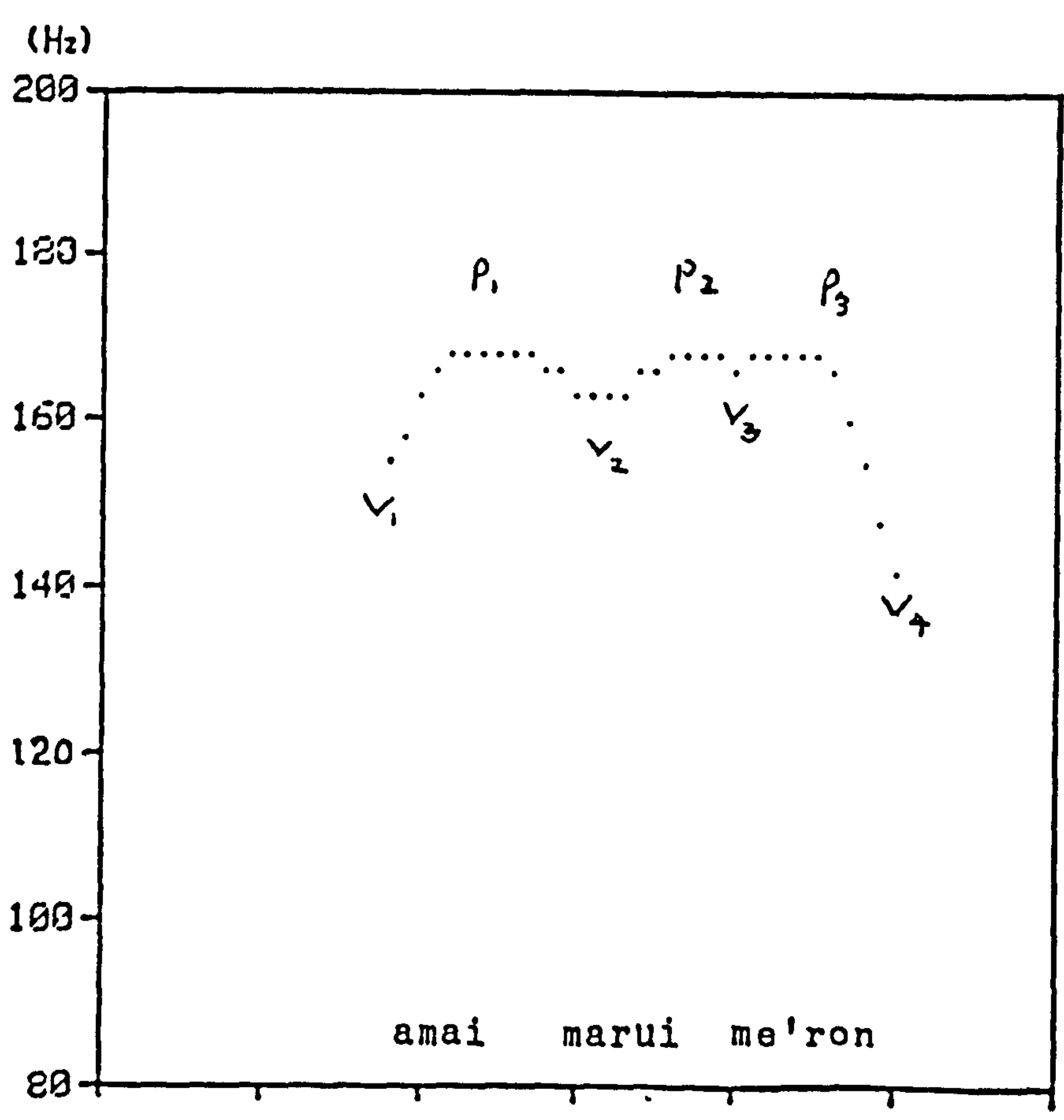


Figure 5.10

(1b) \wedge $\begin{matrix} + + + \\ - + + \end{matrix}$

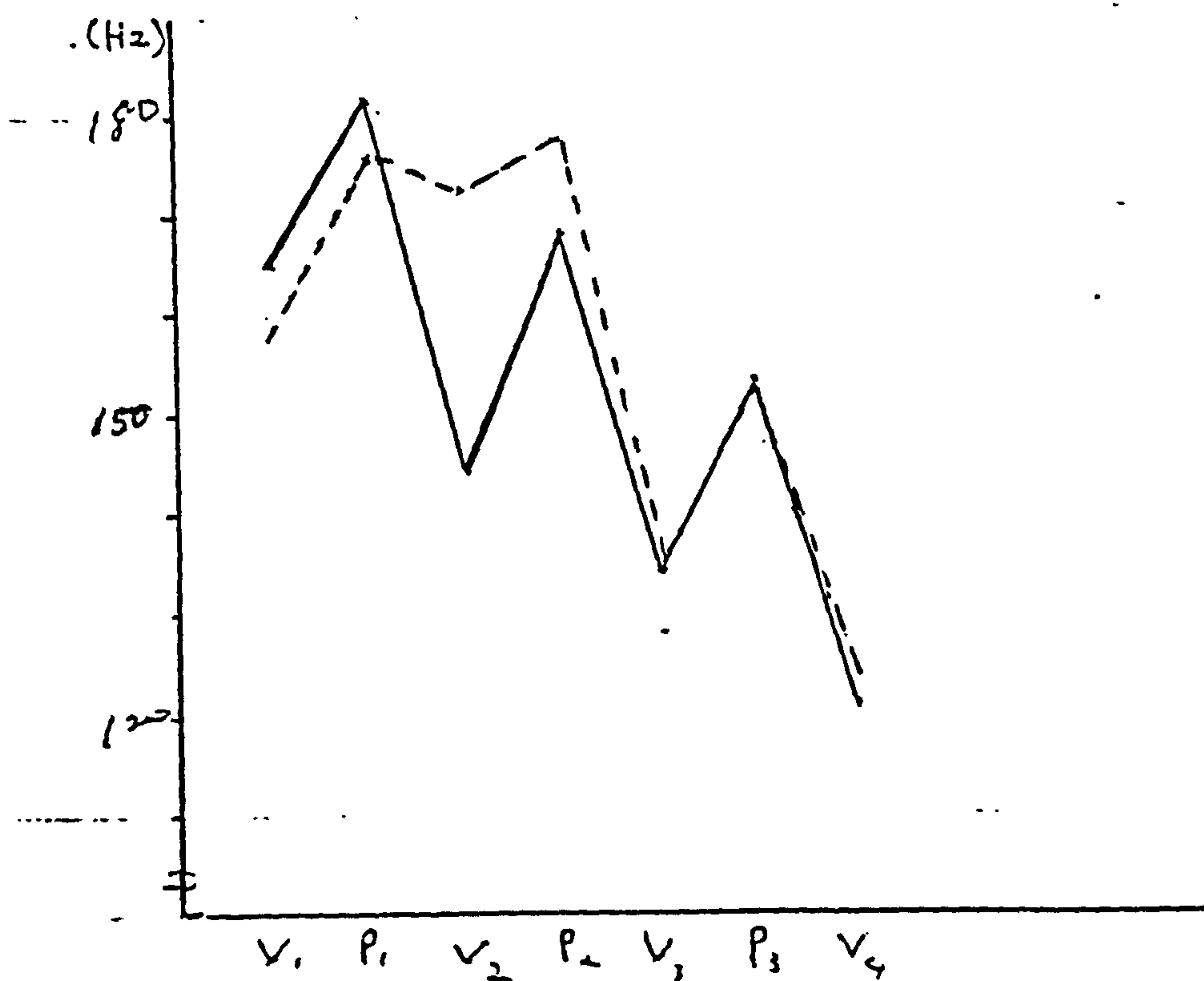


Figure 5.11

(1a) \wedge [+ + +] —————

(1c) \wedge [+ - +] - - - - -

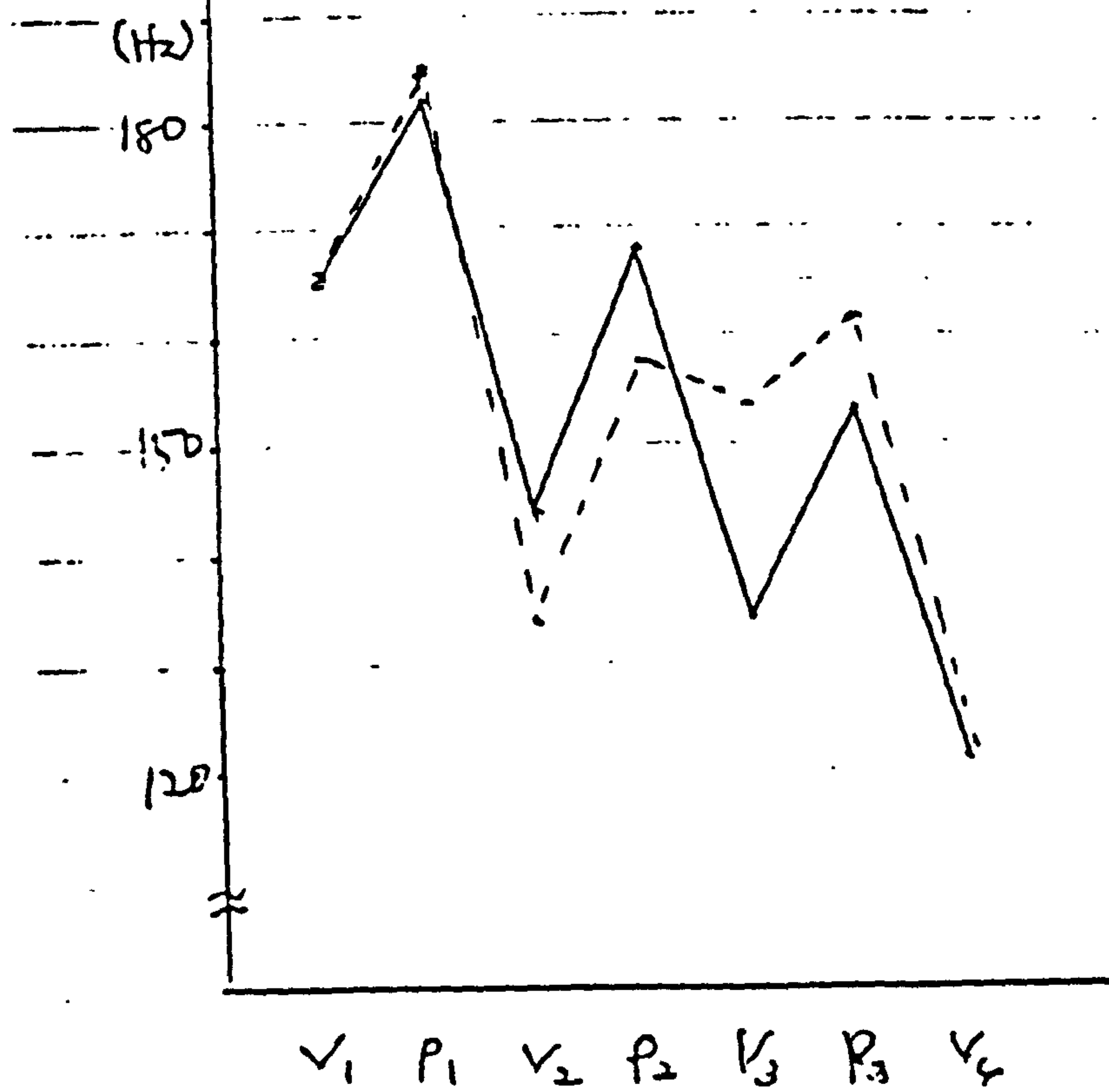


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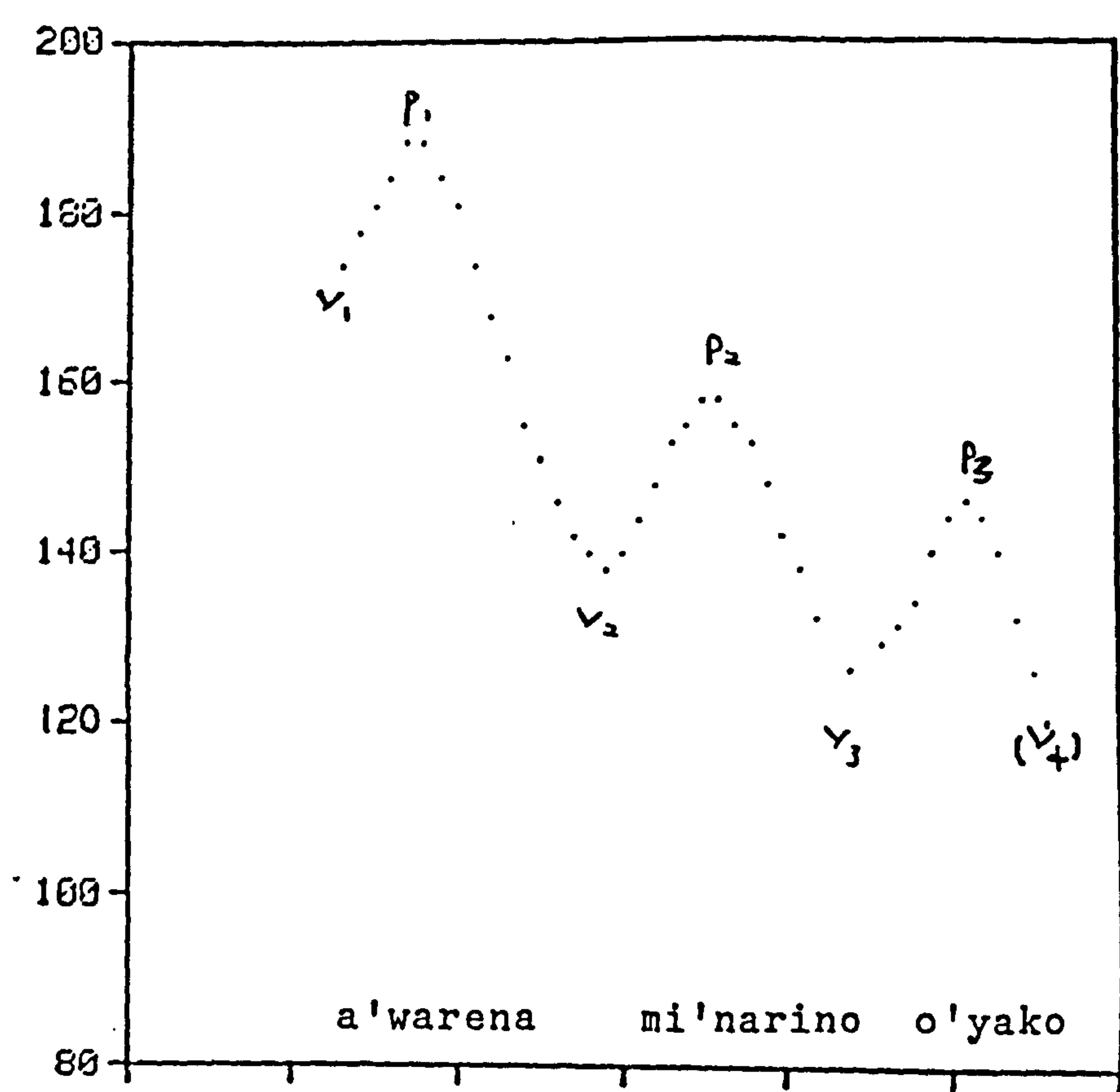


Figure 5.13

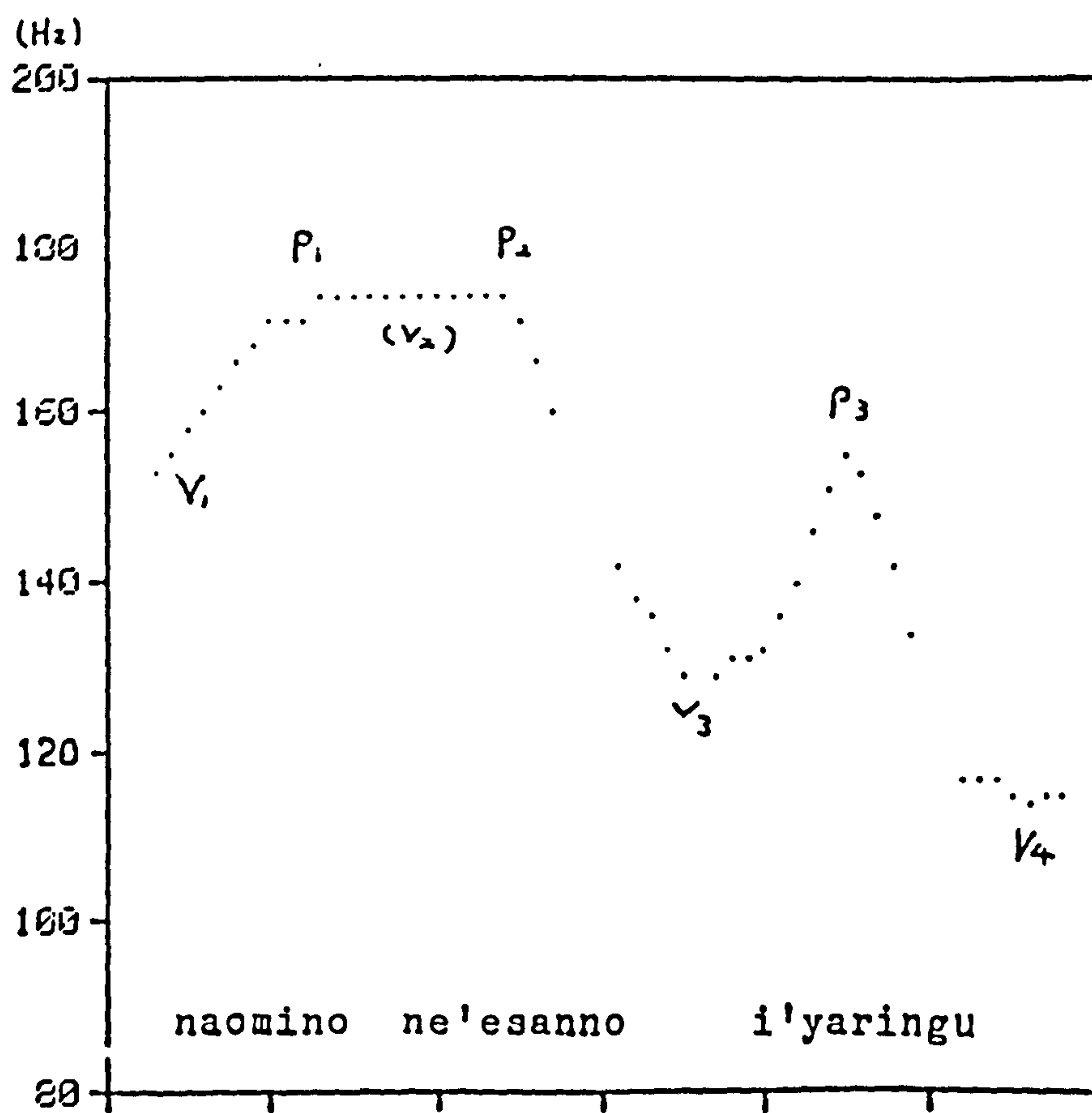


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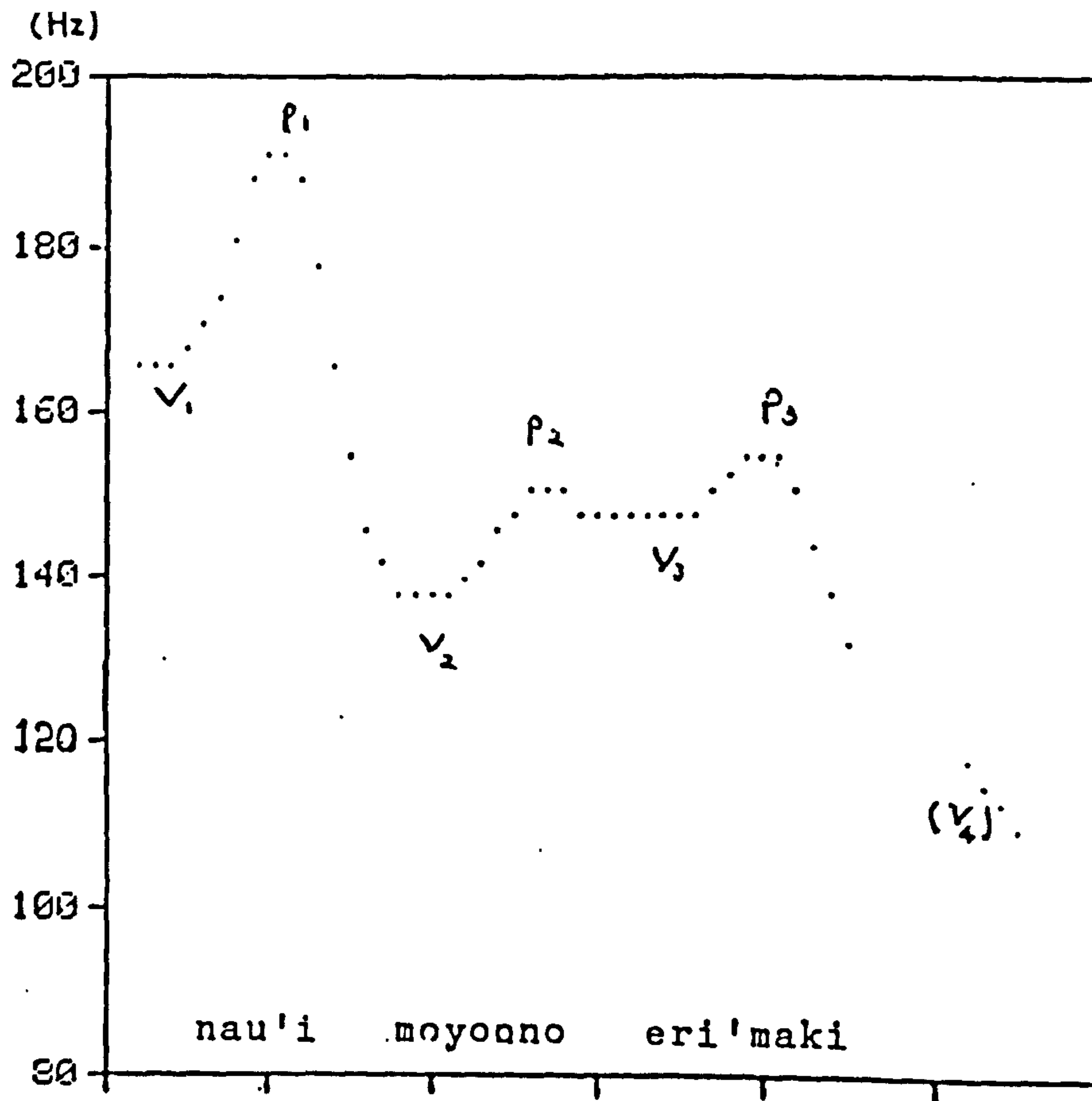


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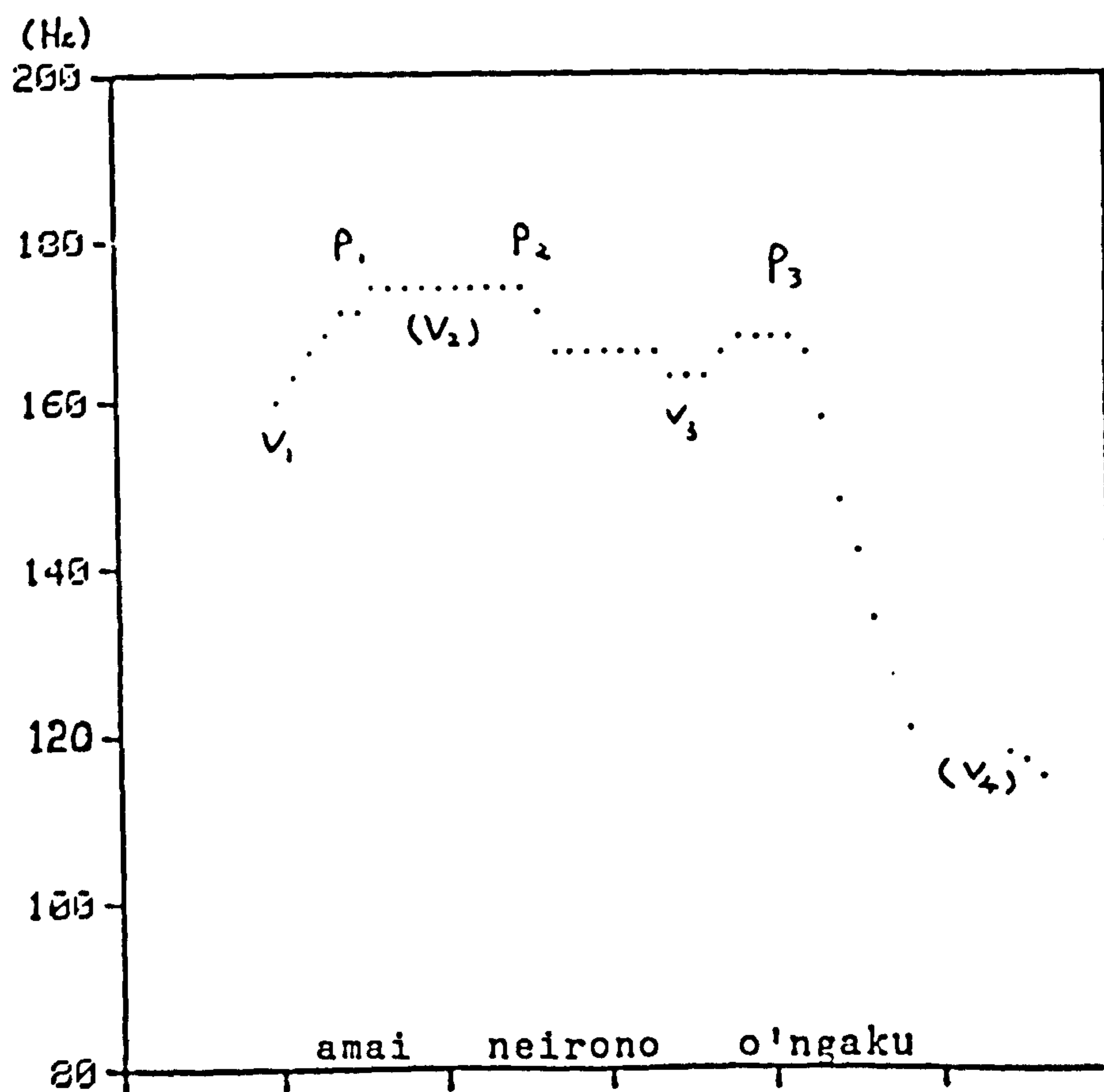


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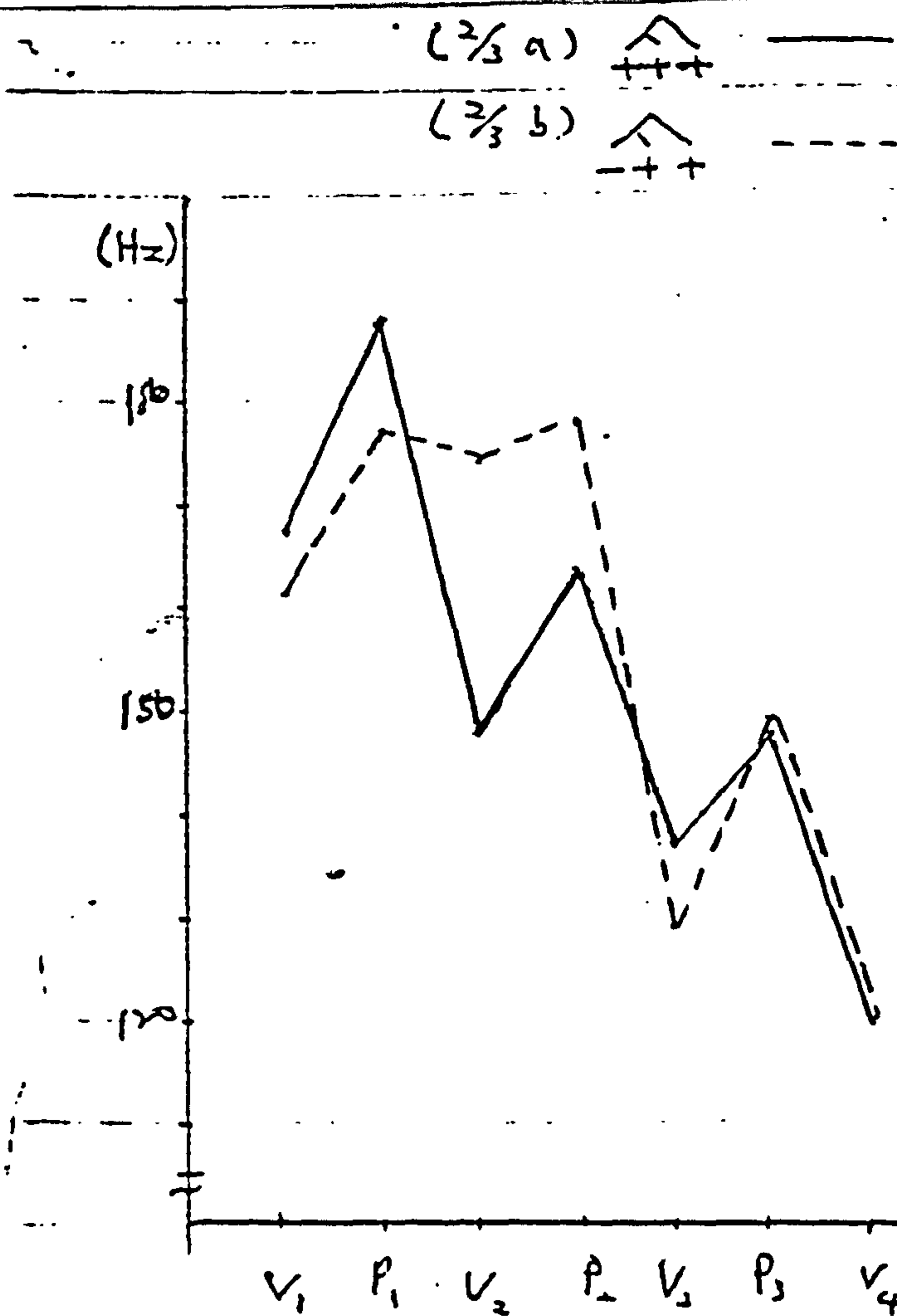


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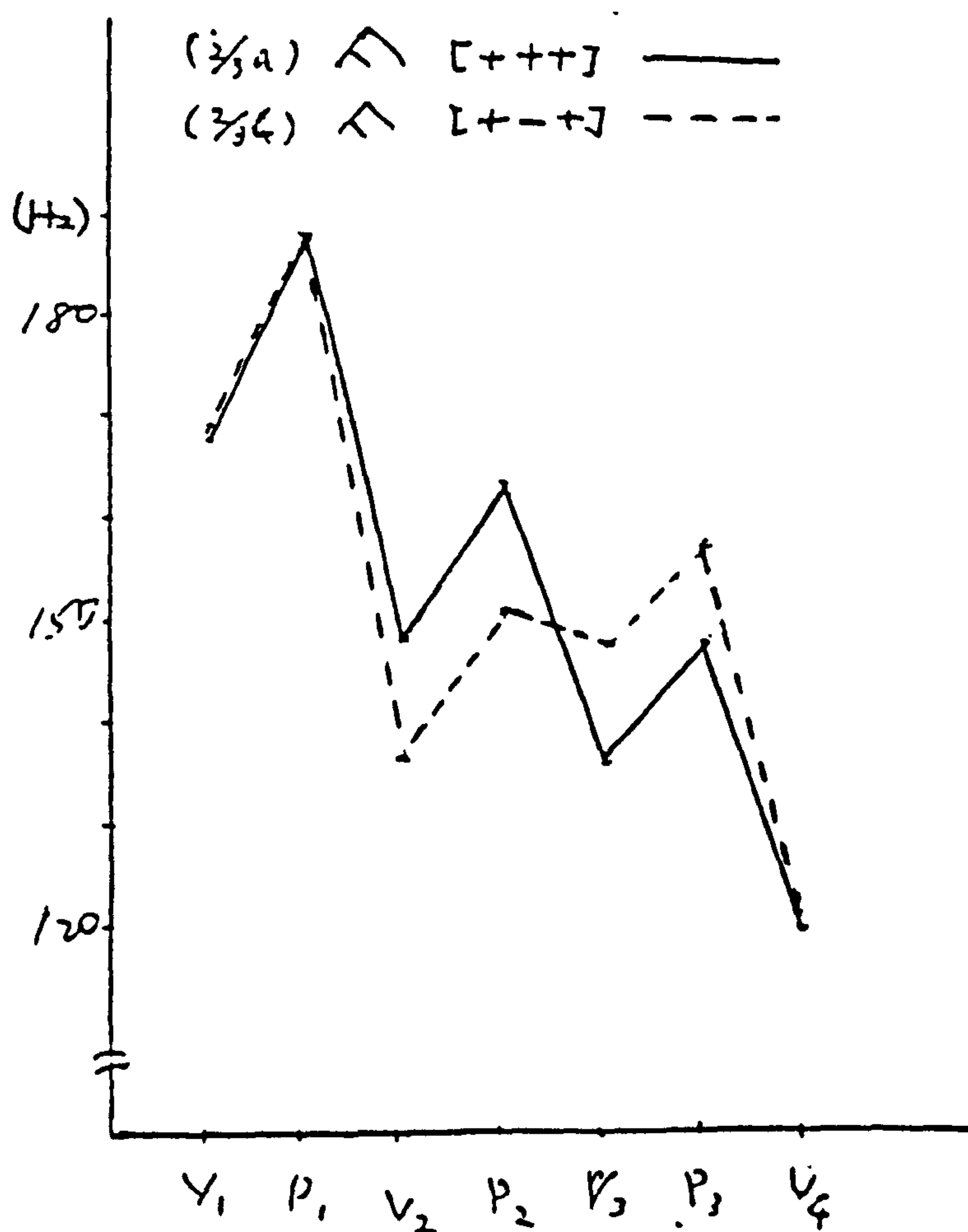


Figure 5.18 554

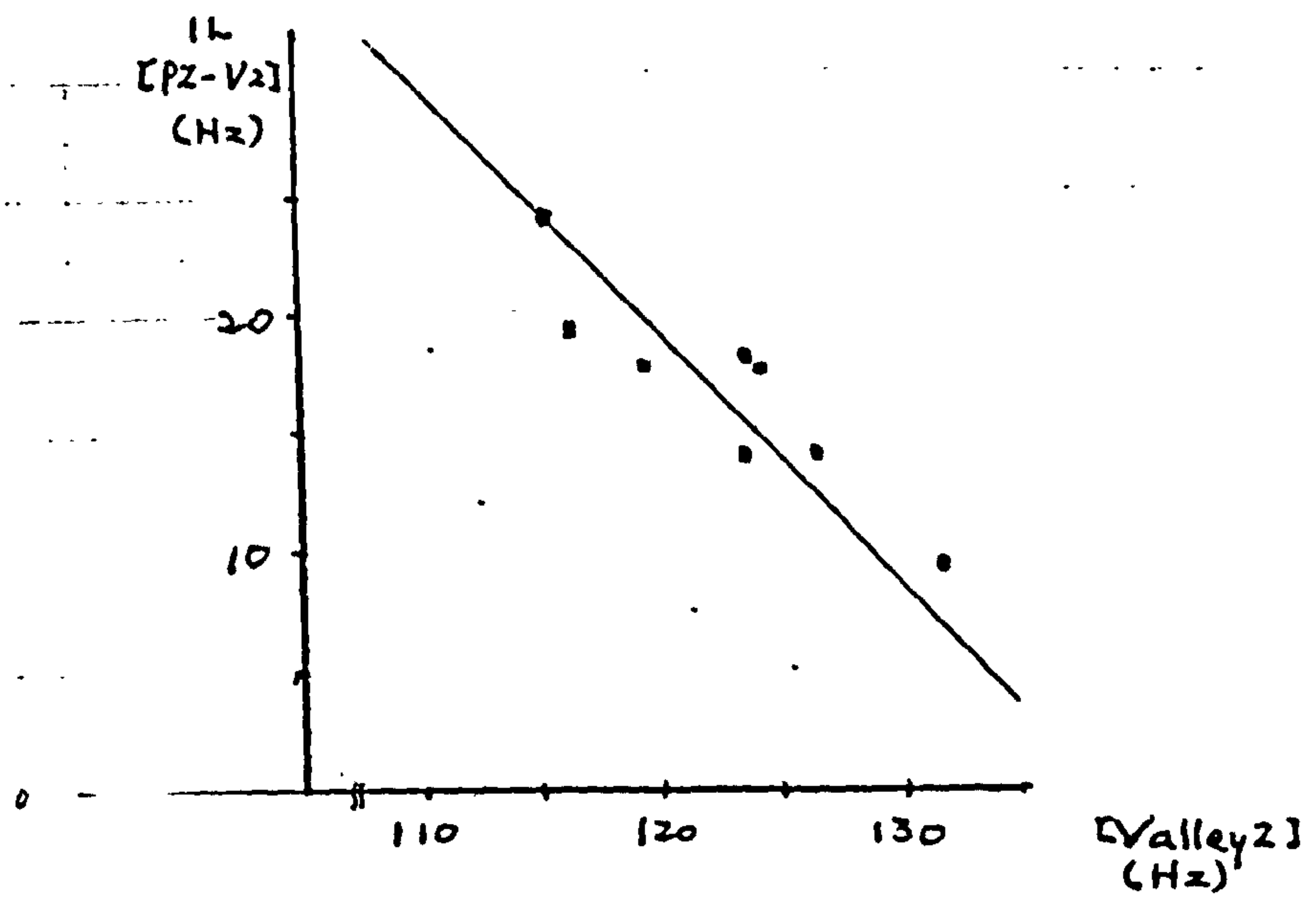


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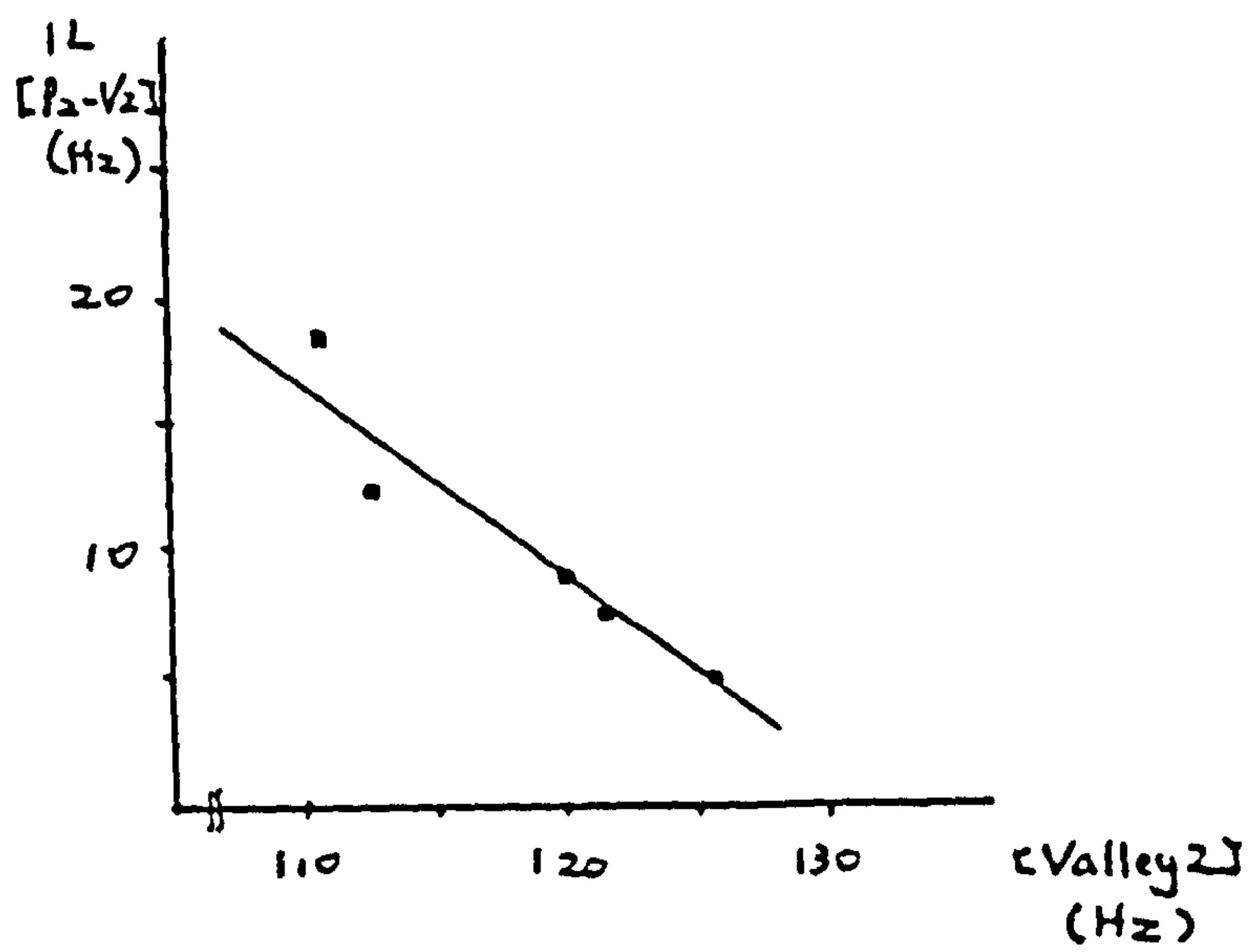


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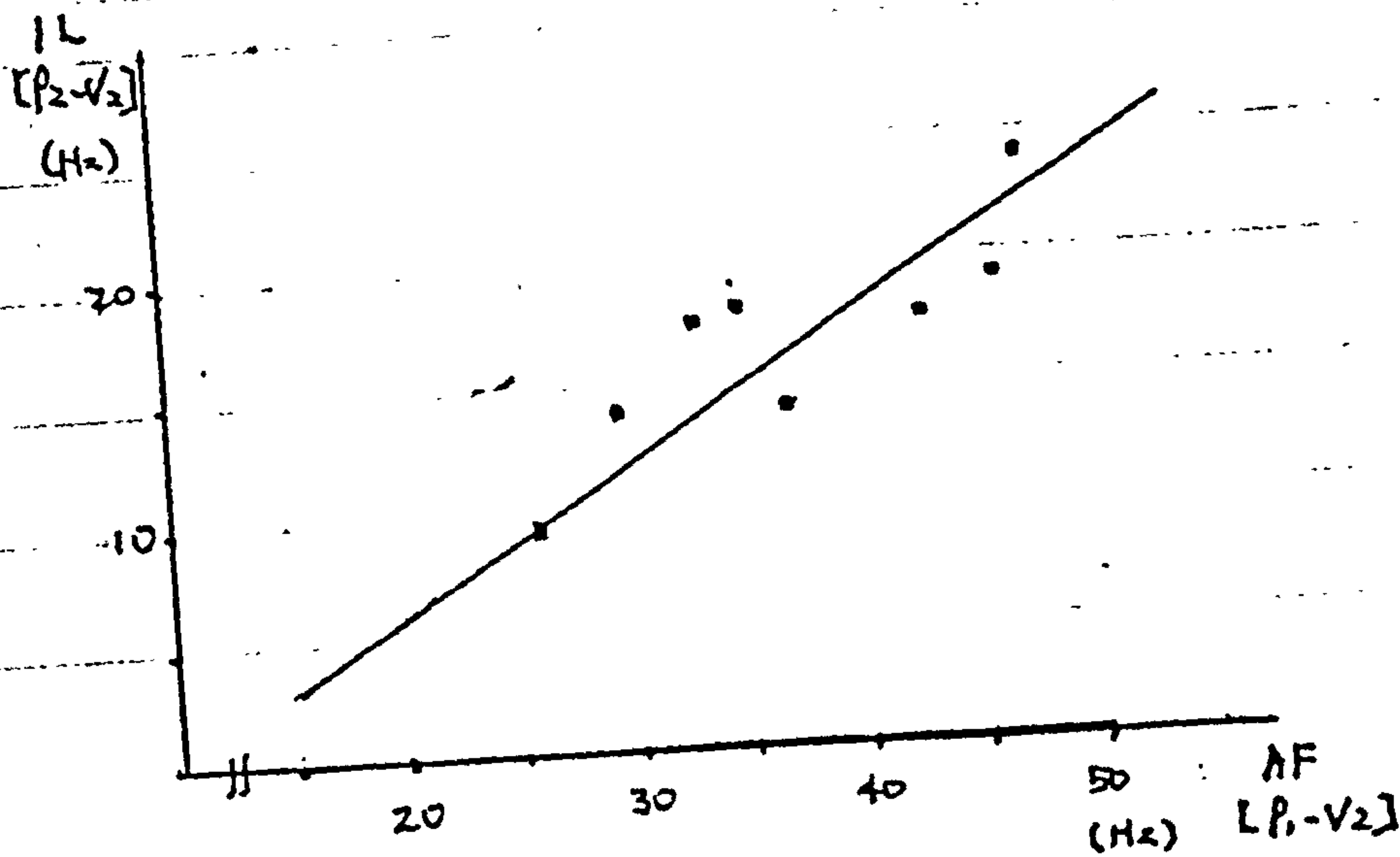


Figure 5.21

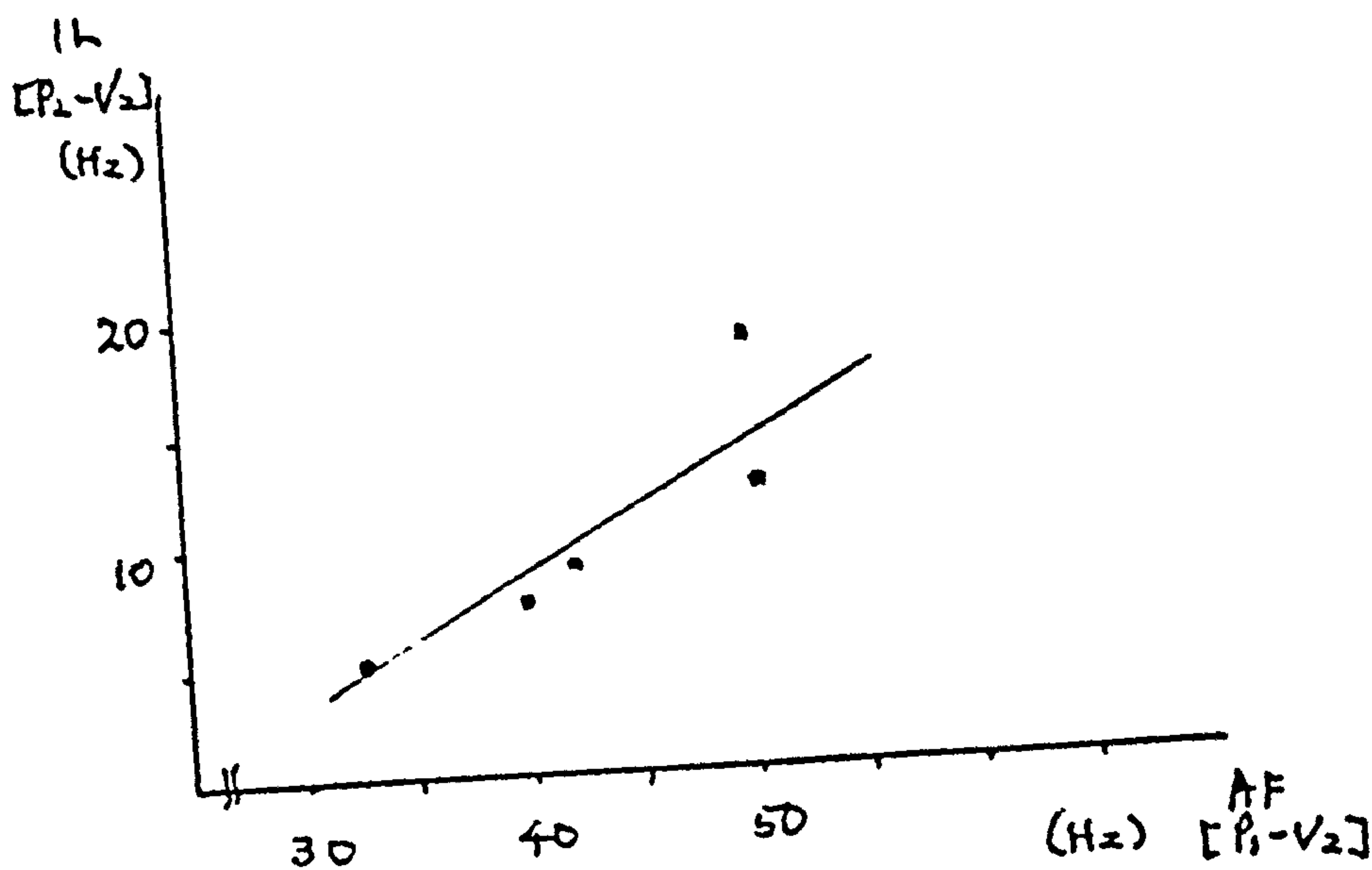


Figure 5.22

5 : 3

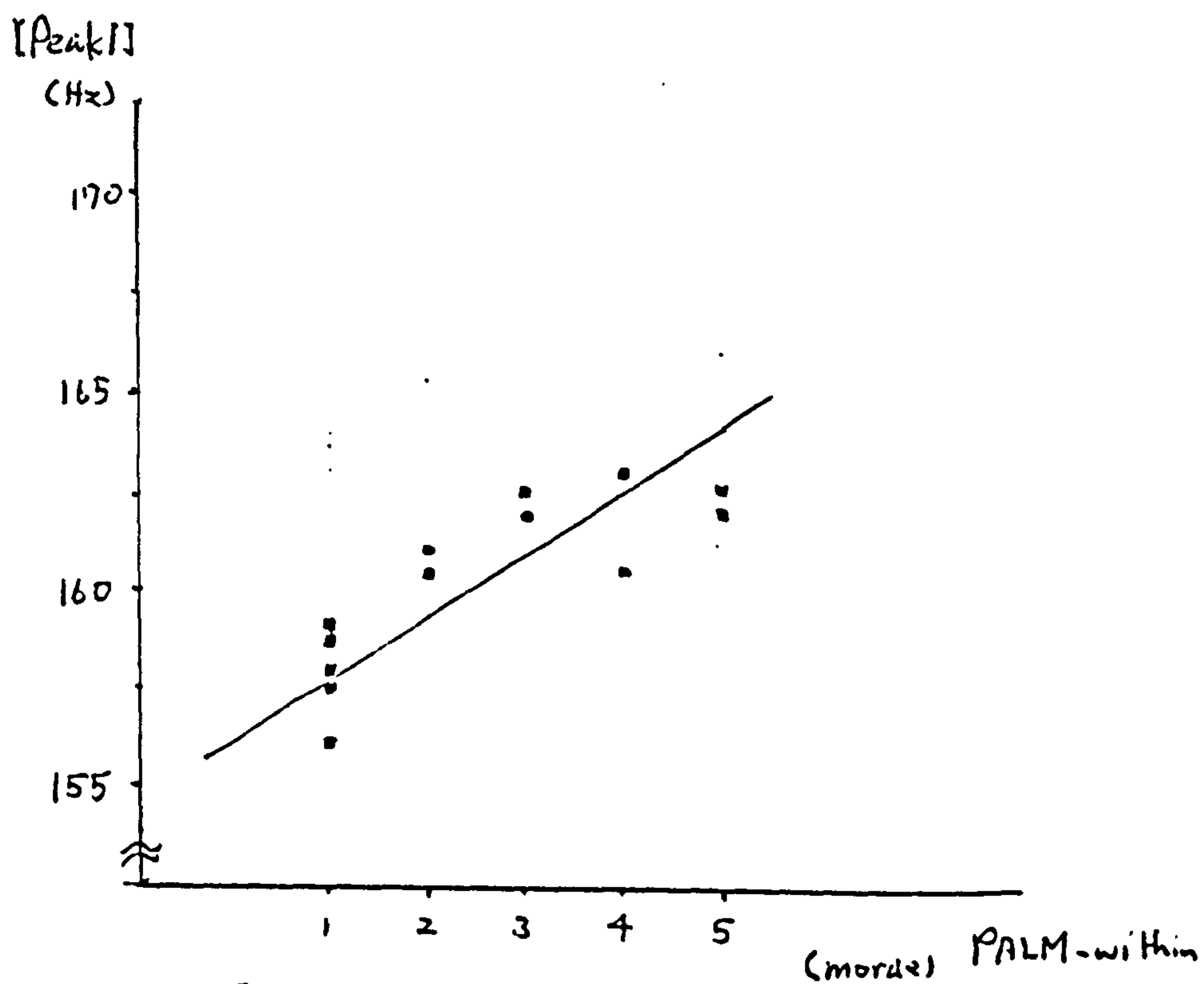


Figure 5.23

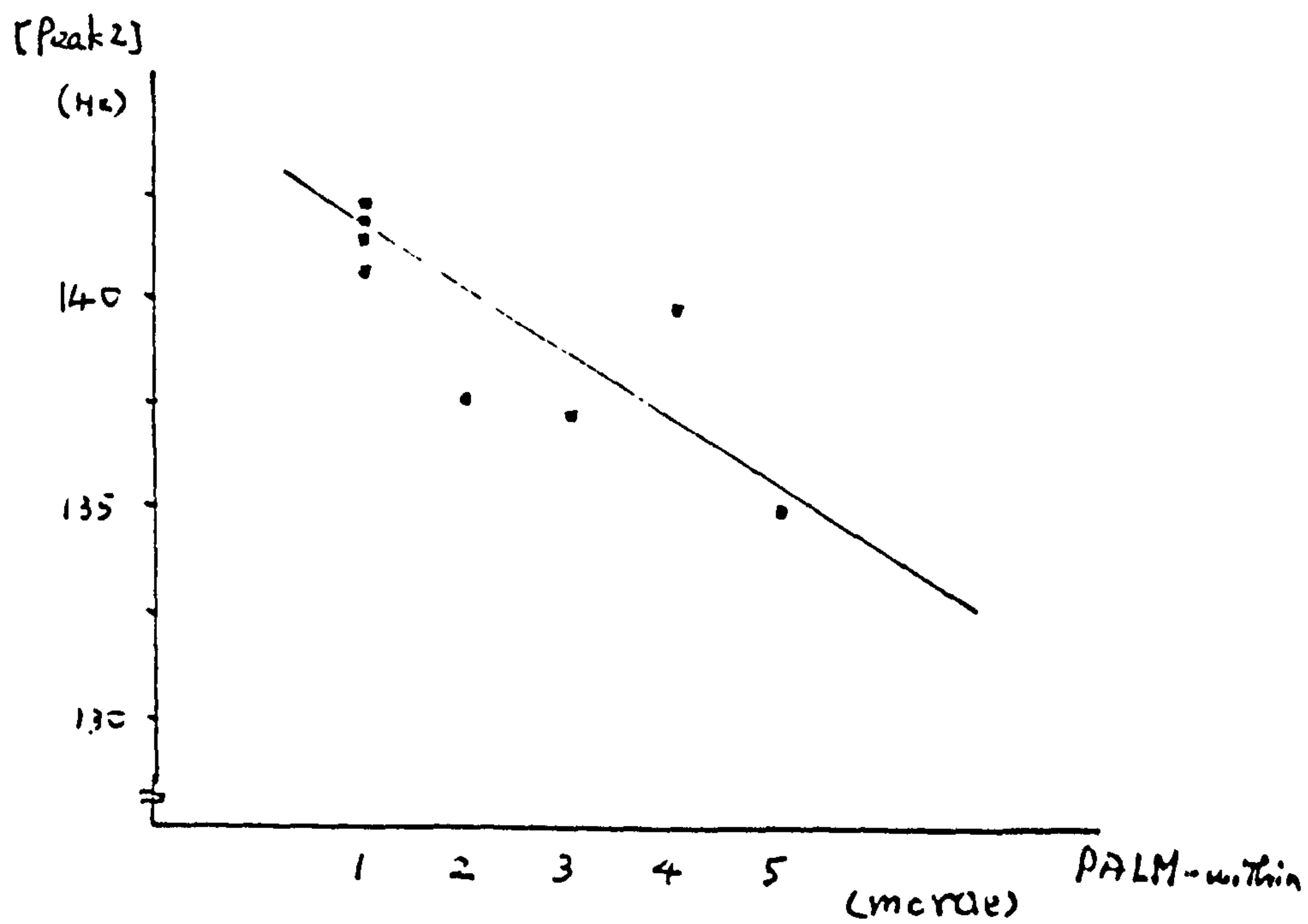


Figure 5.24

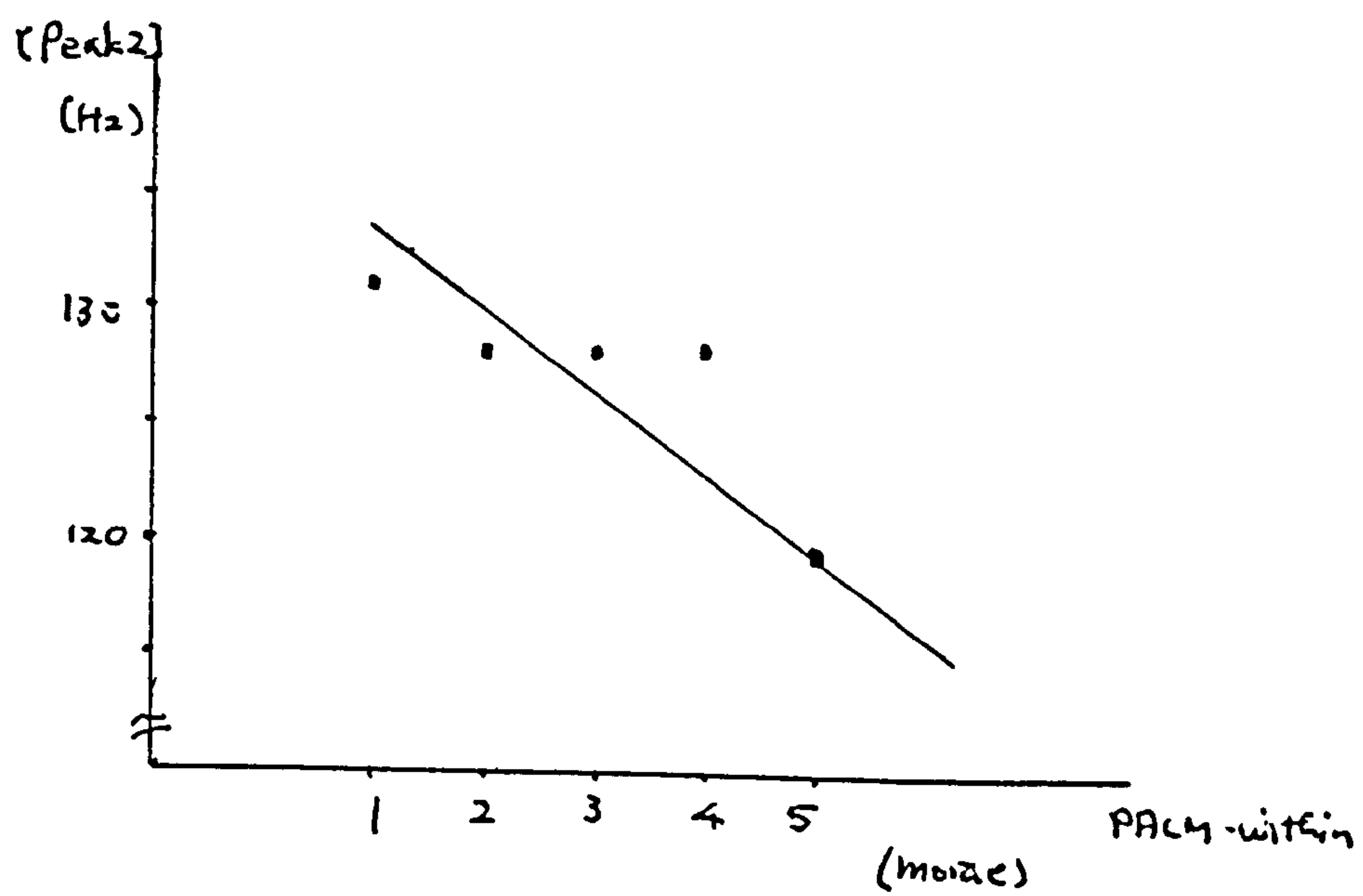


Figure 5.25

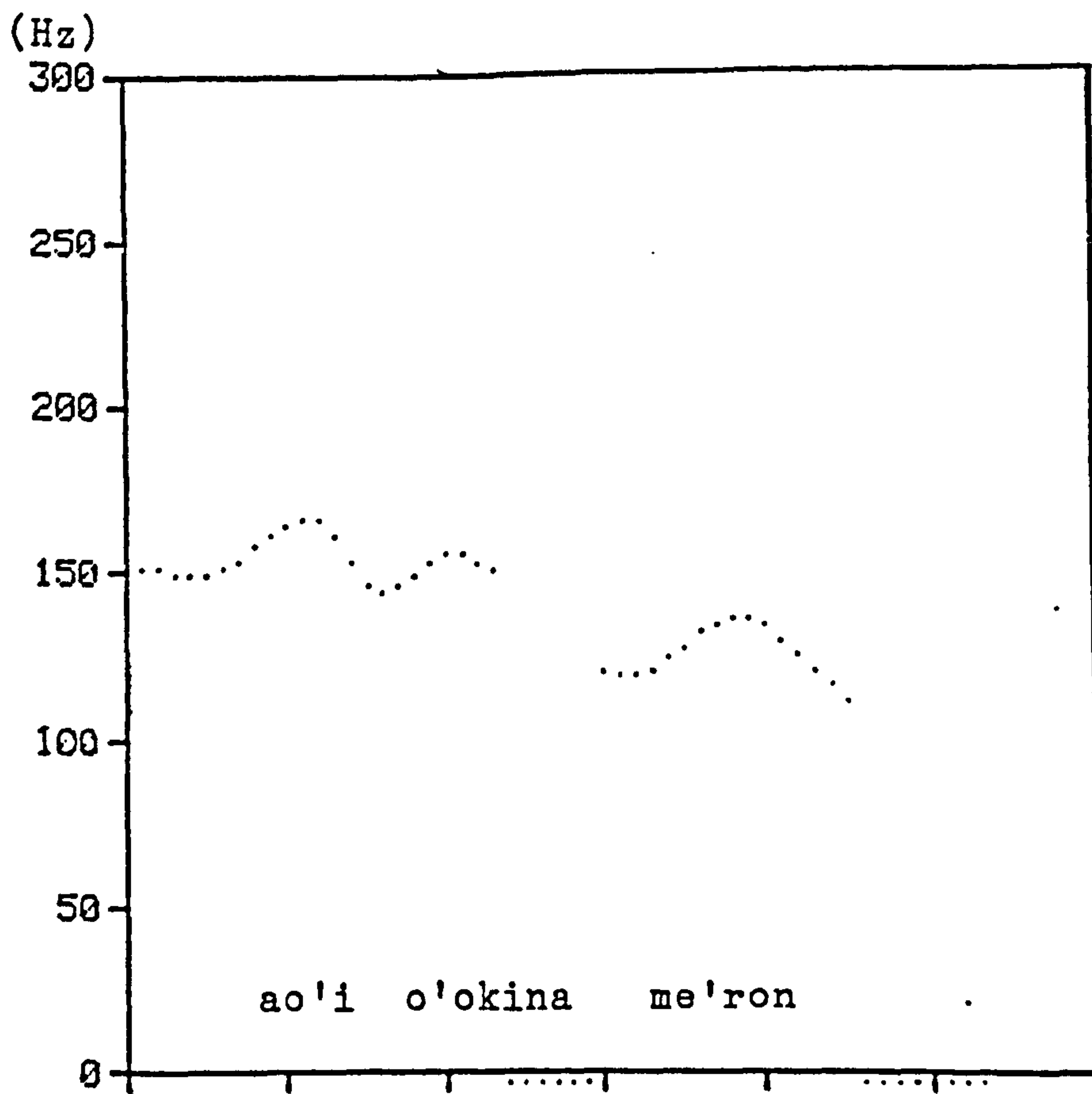


Figure 5.26

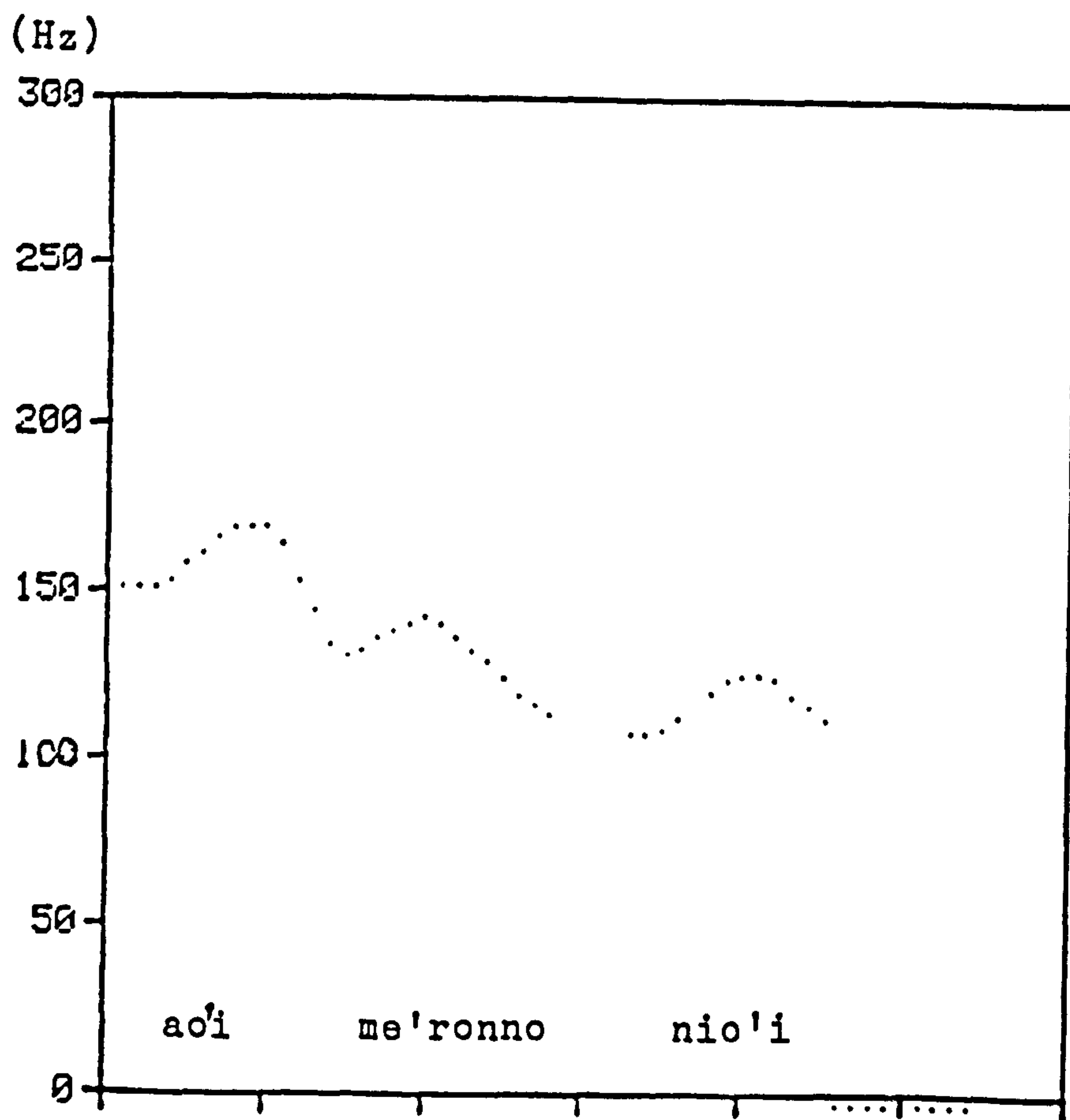


Figure 5.27

$\begin{array}{c} \triangle \\ + + + \end{array}$ — $a\sigma^i$ — $\sigma^i o k i n a$ — $m \bar{e} r o n$
 $\begin{array}{c} \triangle \\ + + + \end{array}$ — $a\sigma^i$ — $\gamma e^i m o n n o$ — $n i \sigma^i$

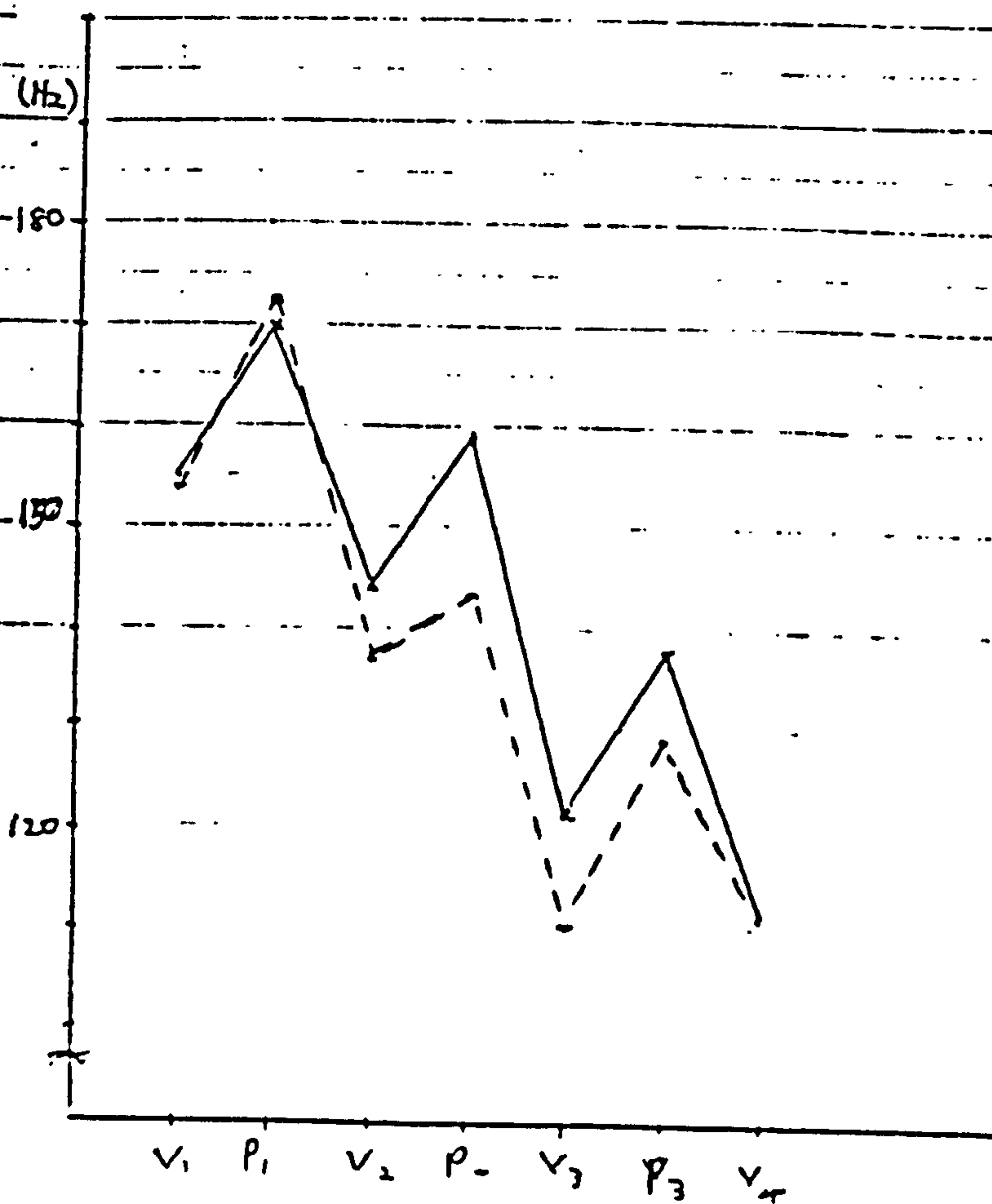


Figure 5.28

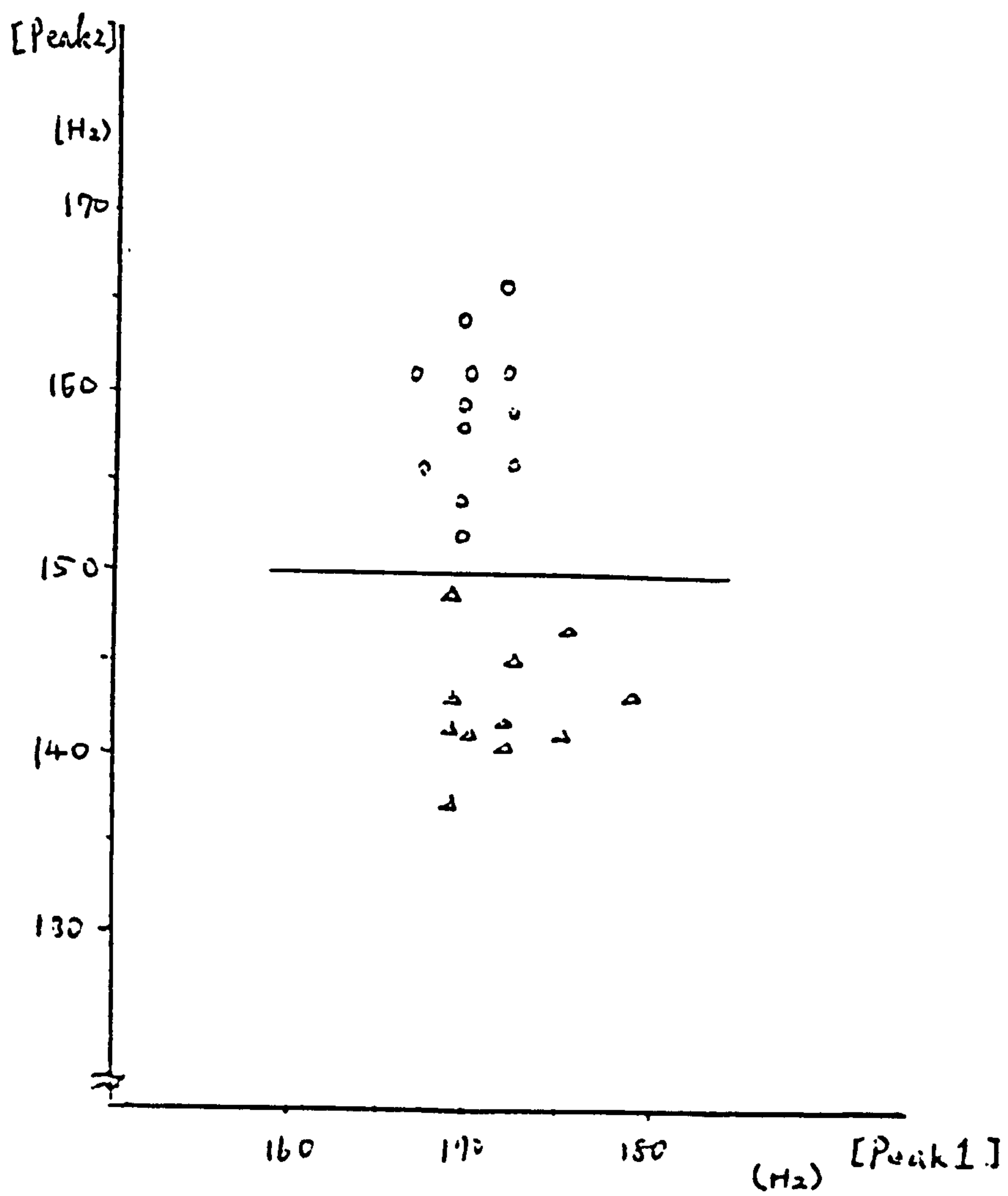


Figure 5. 29

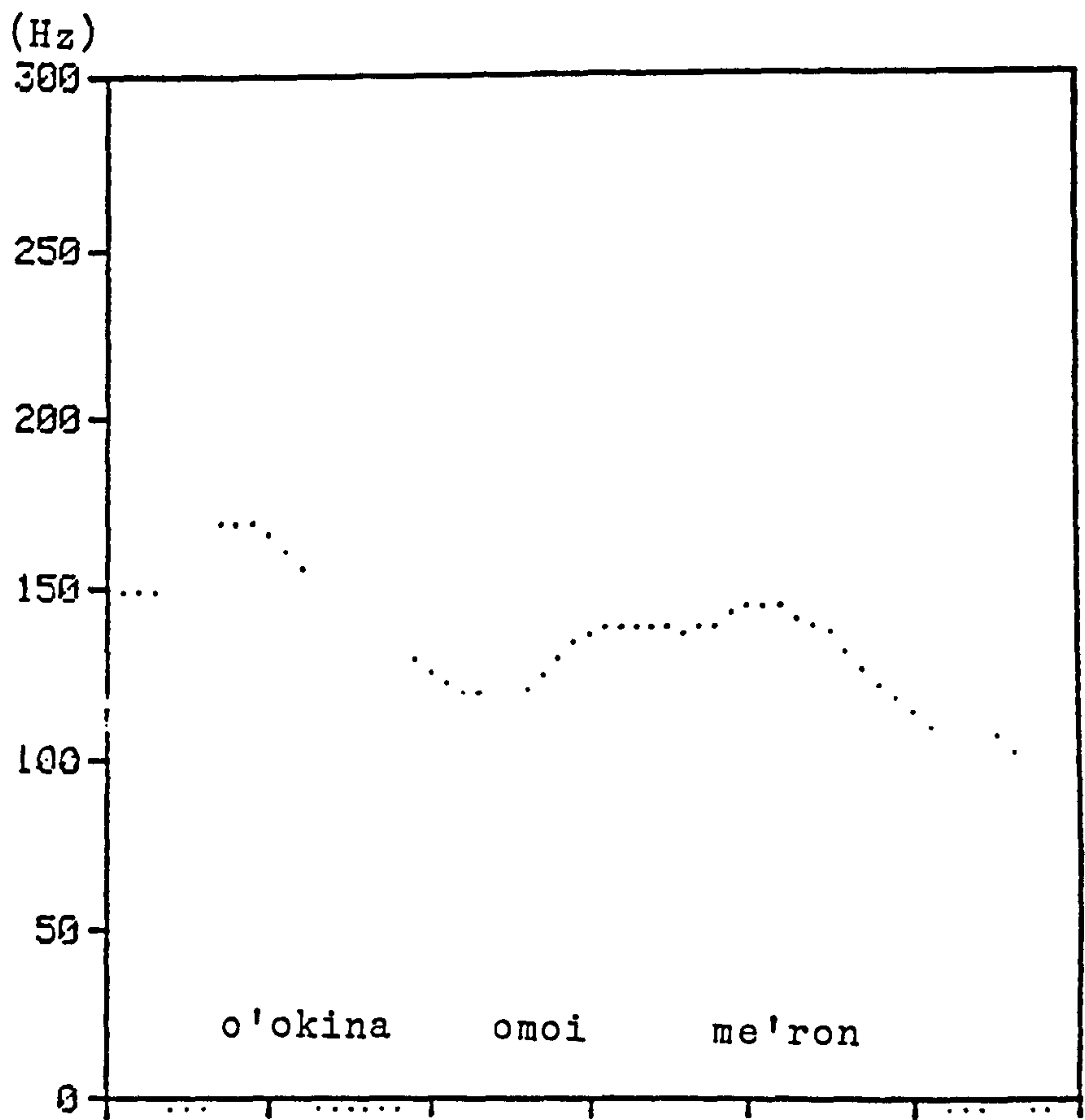


Figure 5.30

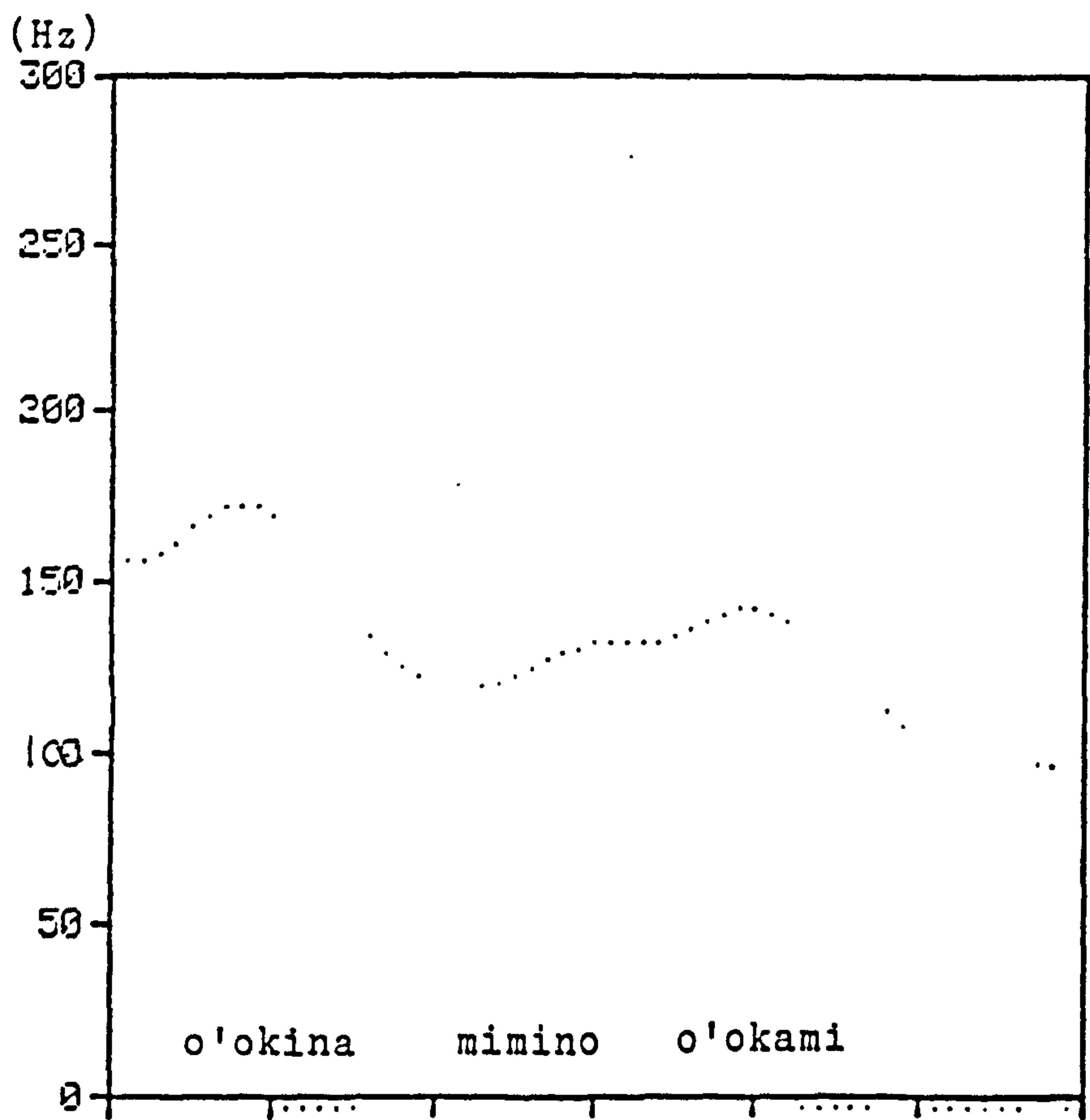


Figure 5.31

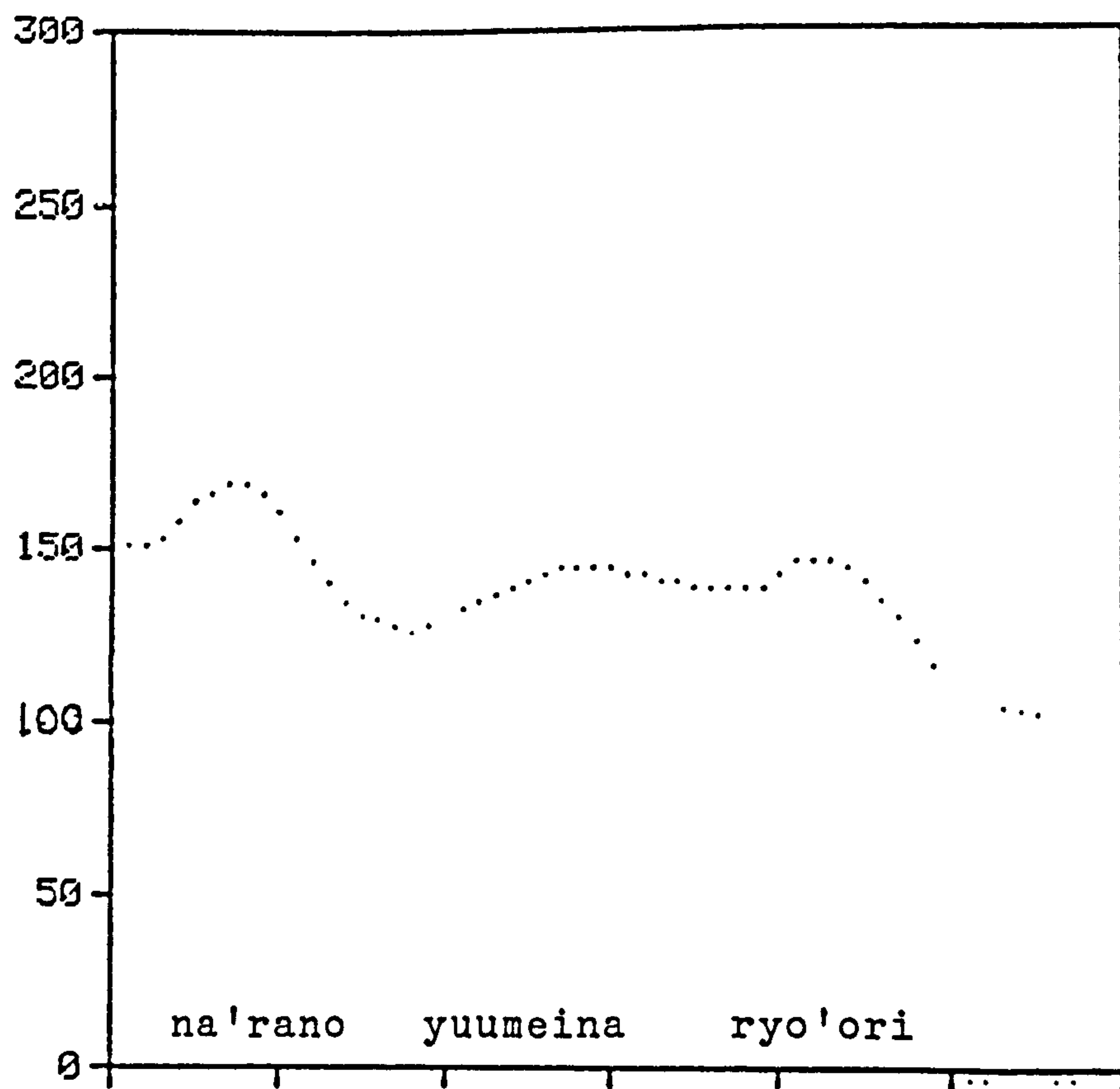


Figure 5.32

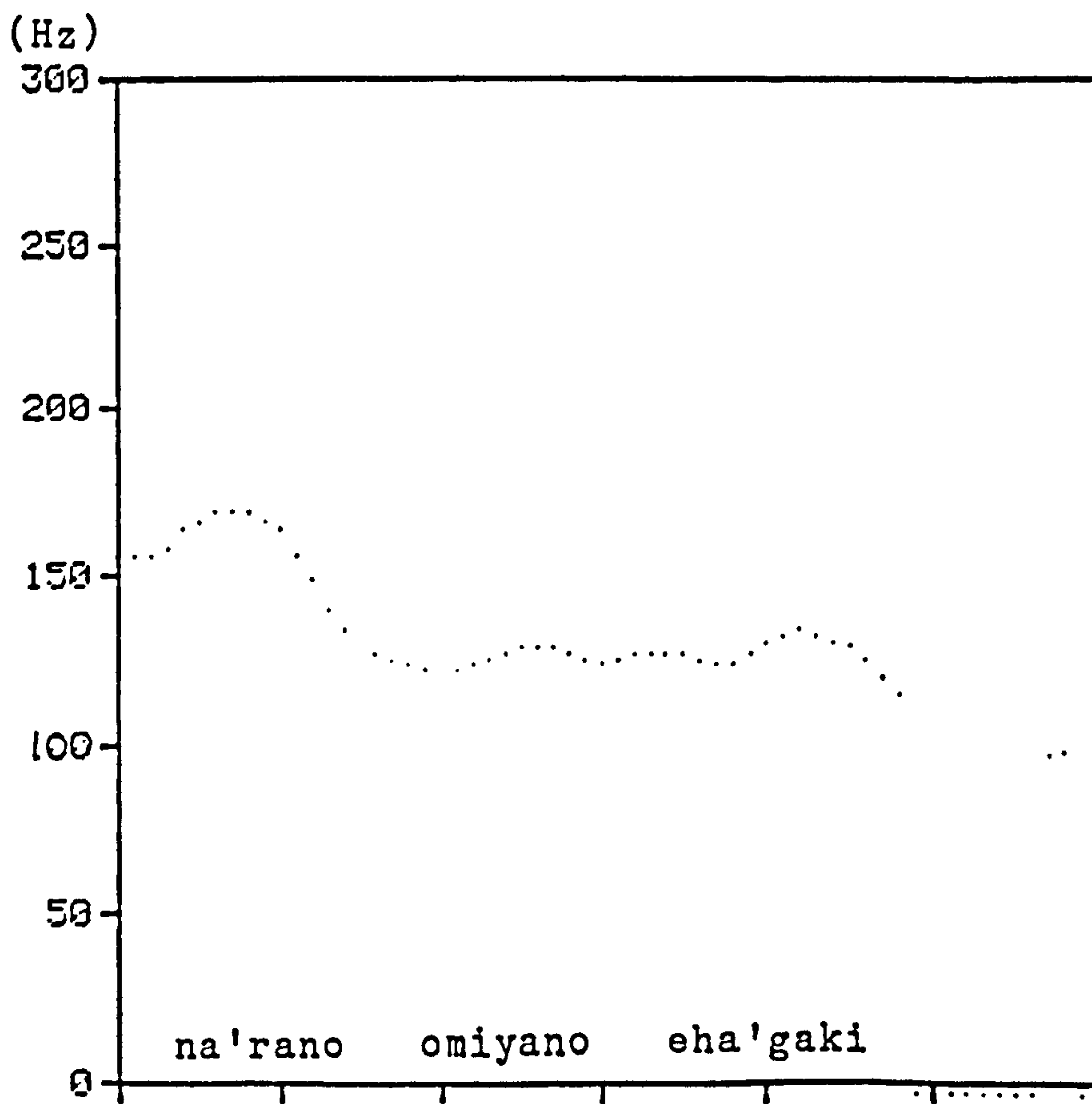


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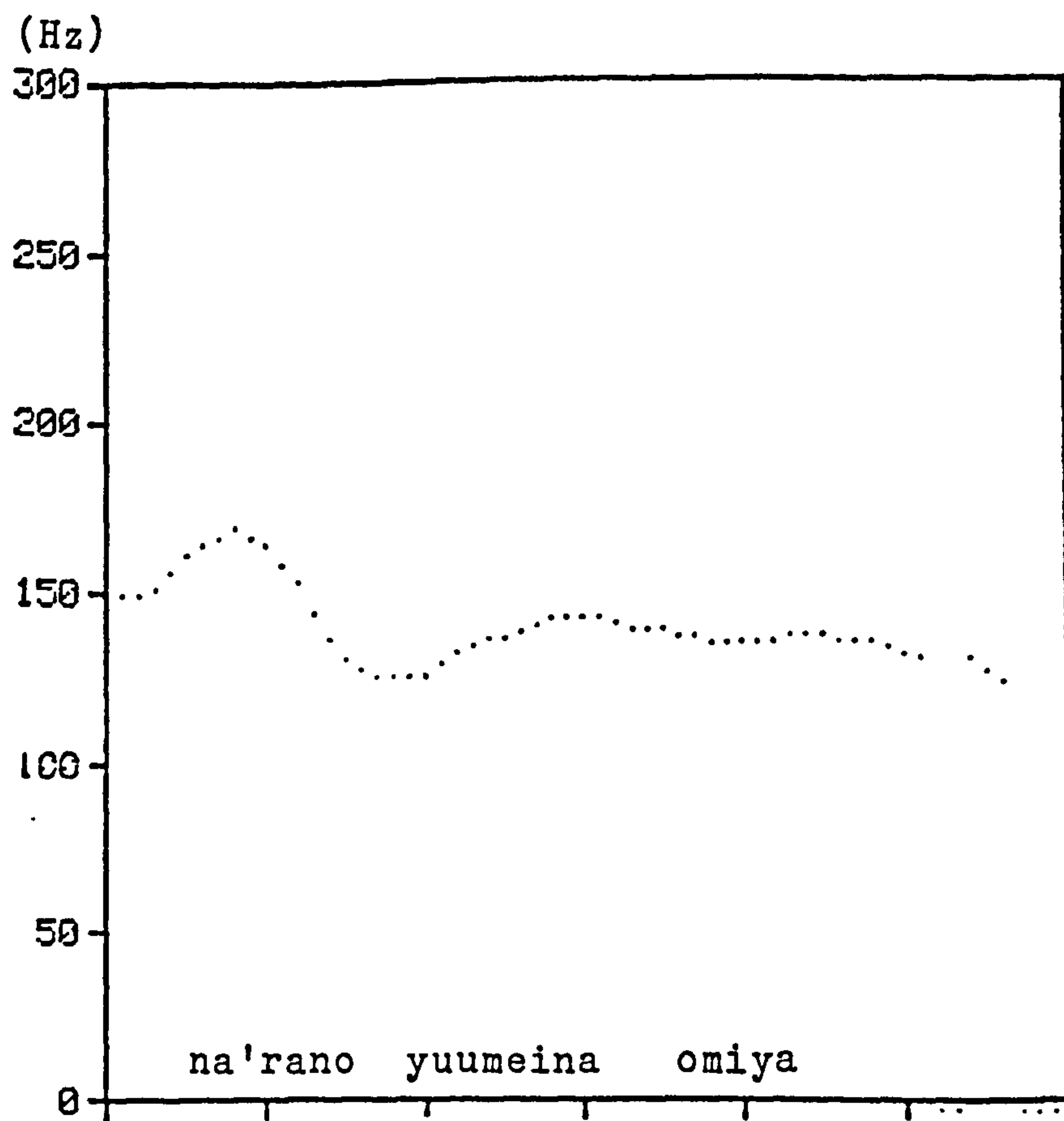


Figure 5.34

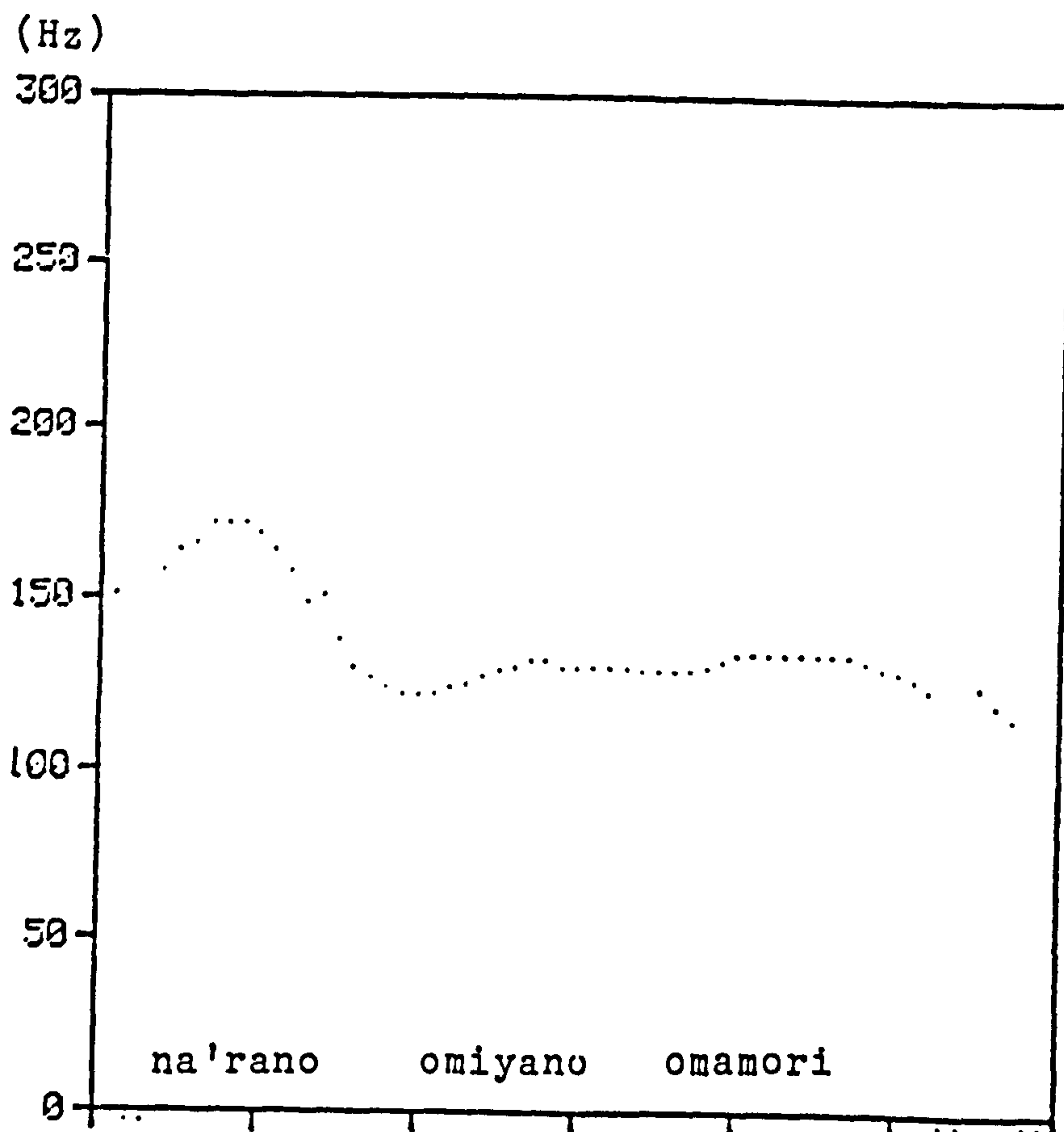


Figure 5.35

—+—+—+ o'okina omoi me'ron
 ---+---+---+ o'okina mimino o'okami

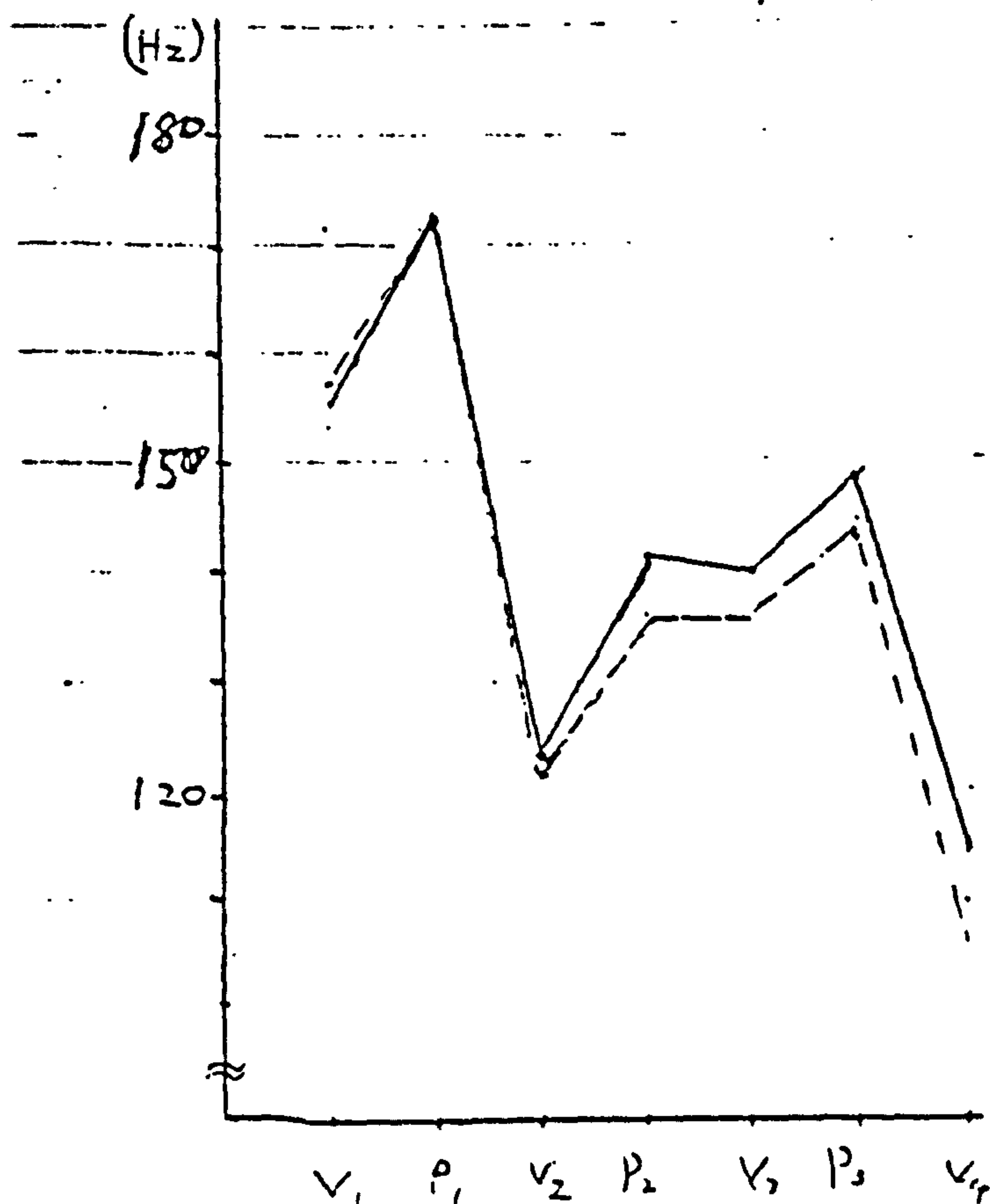


Figure 5.36

—+—+—+ na'rauo yuumeina ryoku
 ---+---+---+ na'rauo o'ni jano ehagale

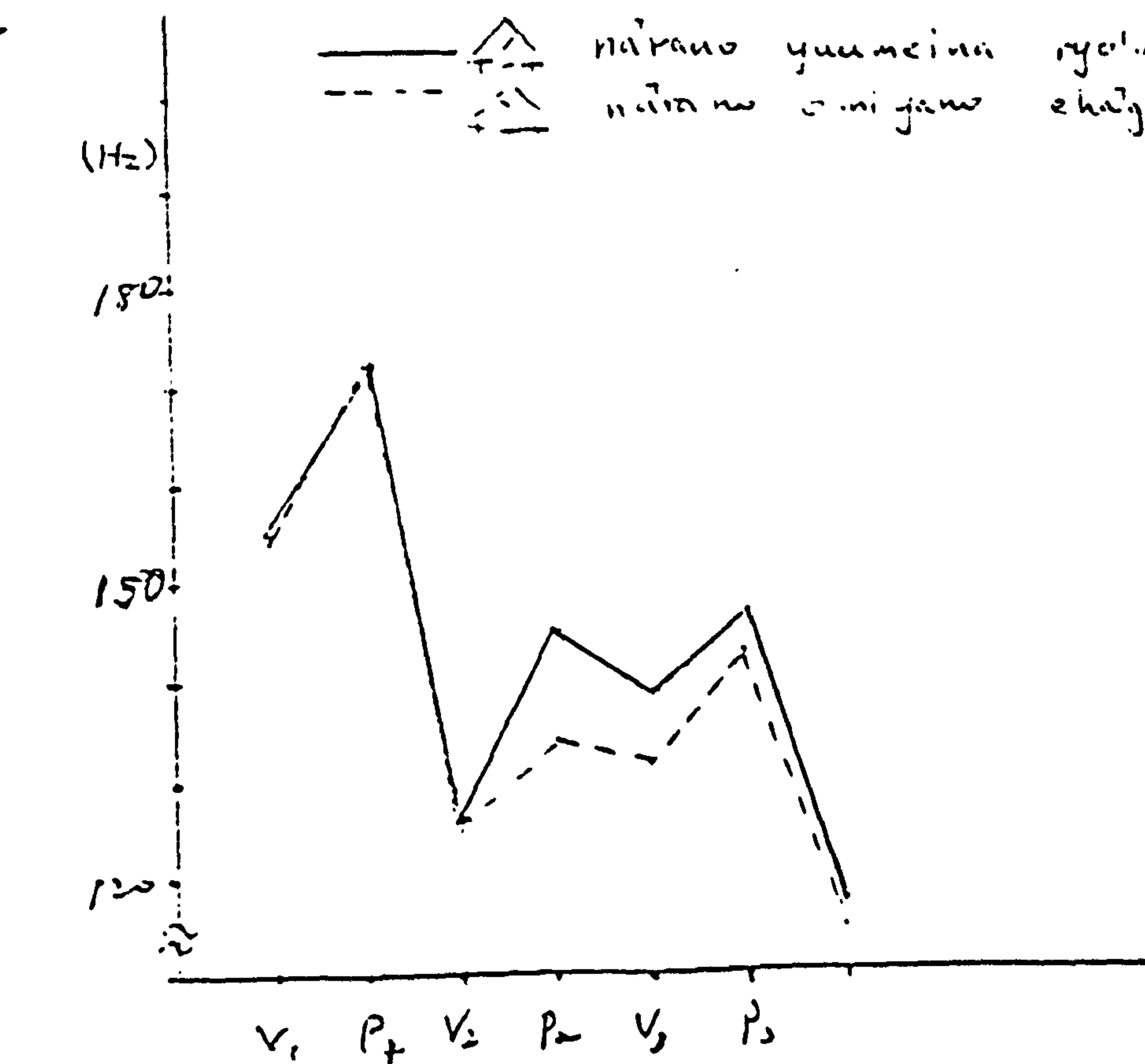


Figure 5.37

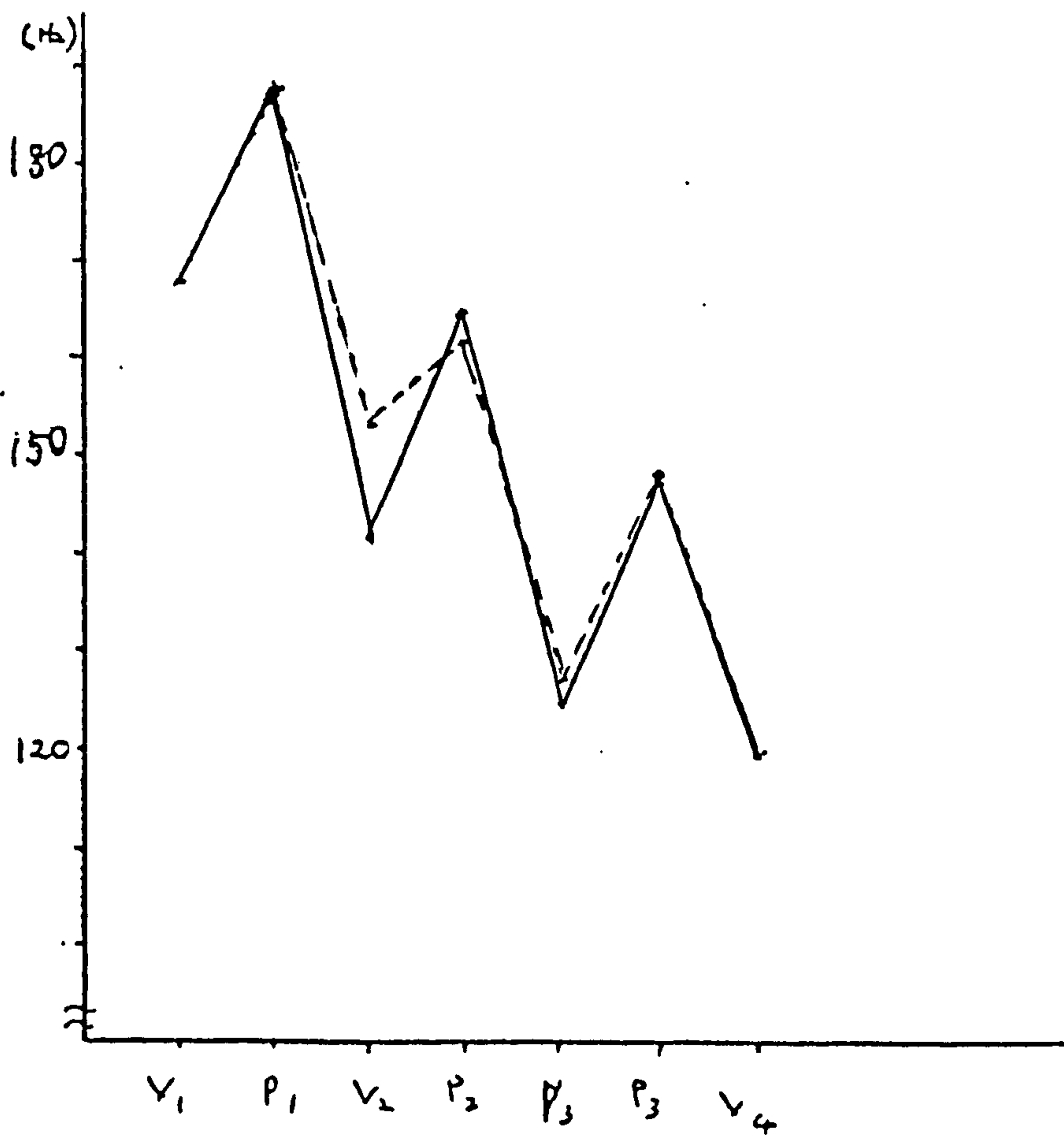


Figure 5.40

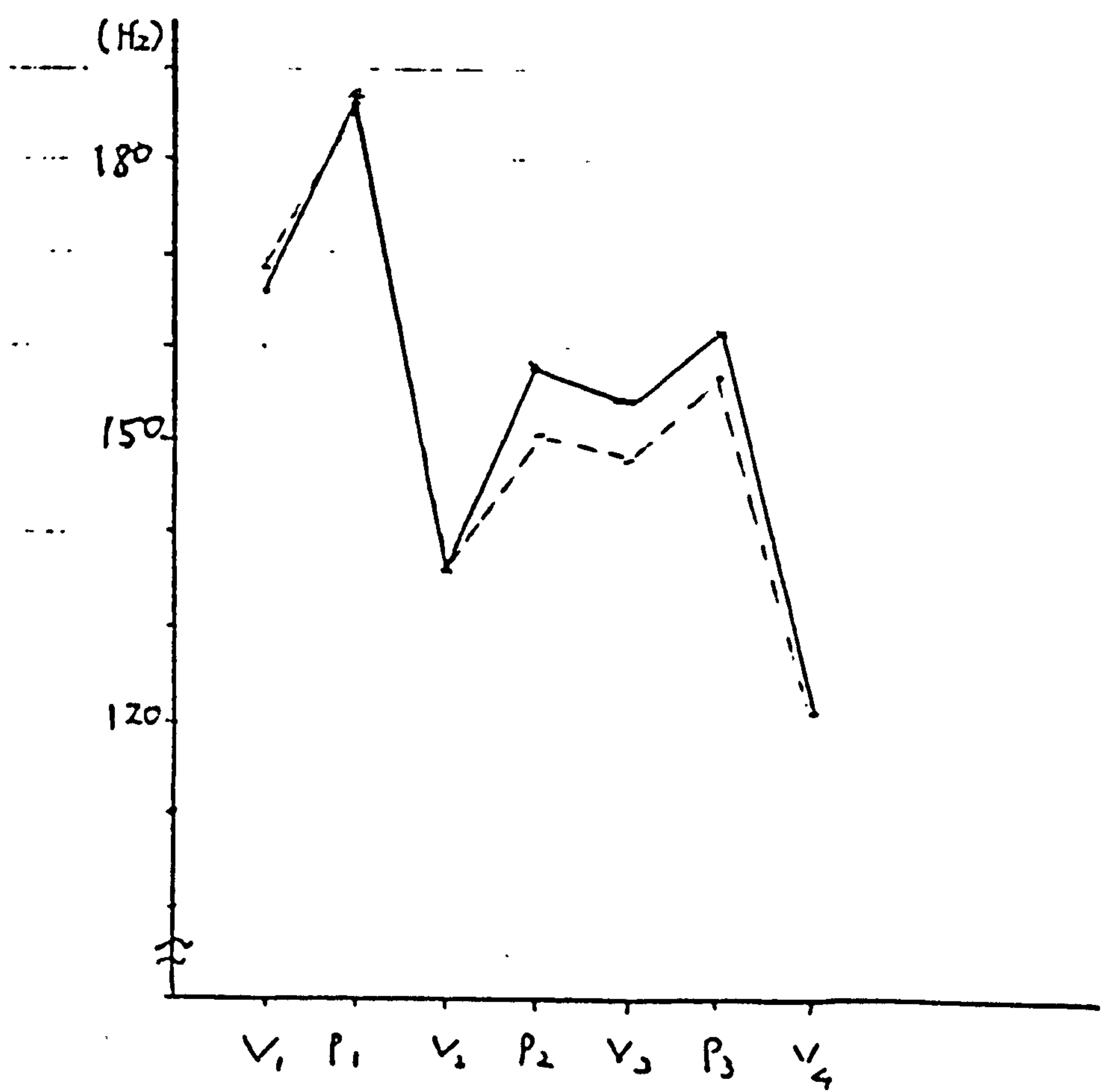
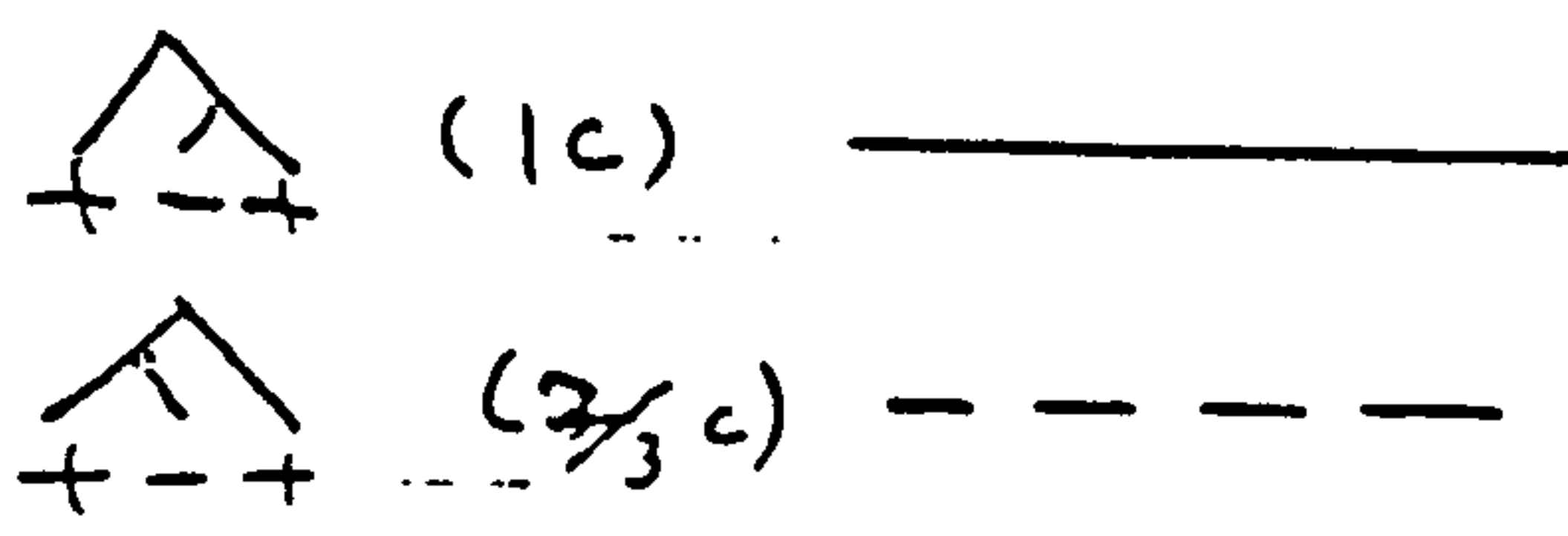


Figure 5.41

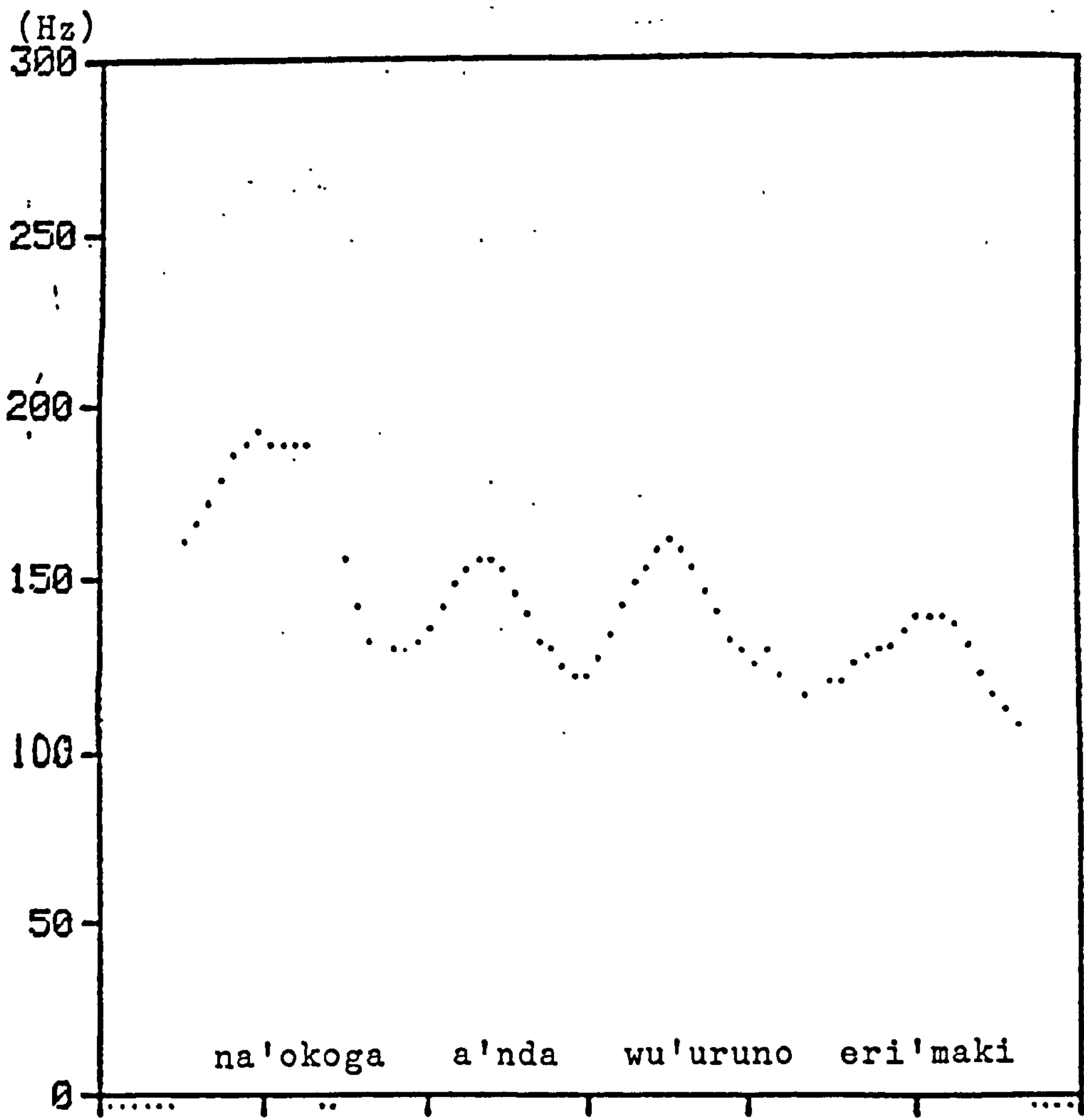


Figure 5.42

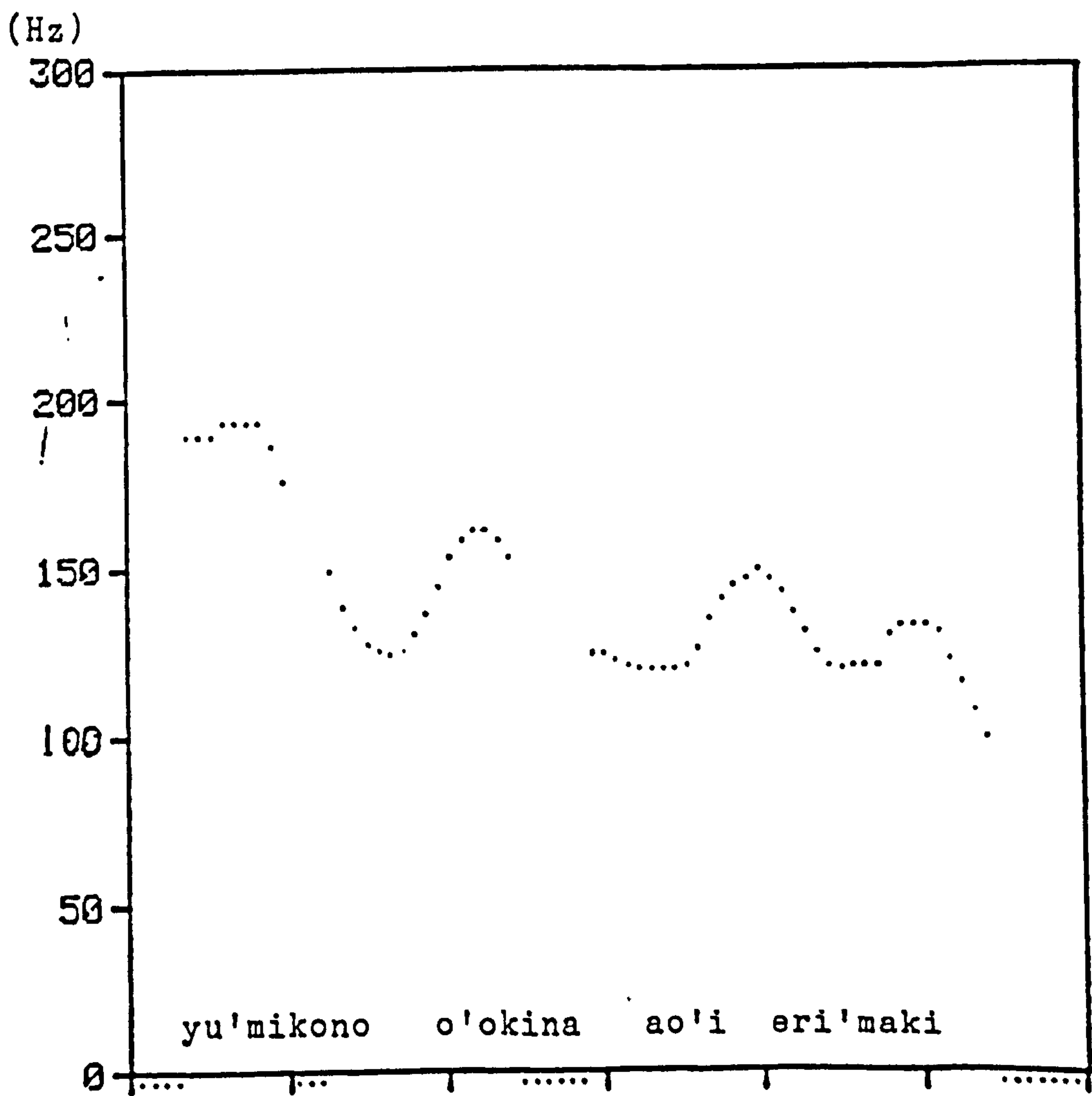


Figure 5.43

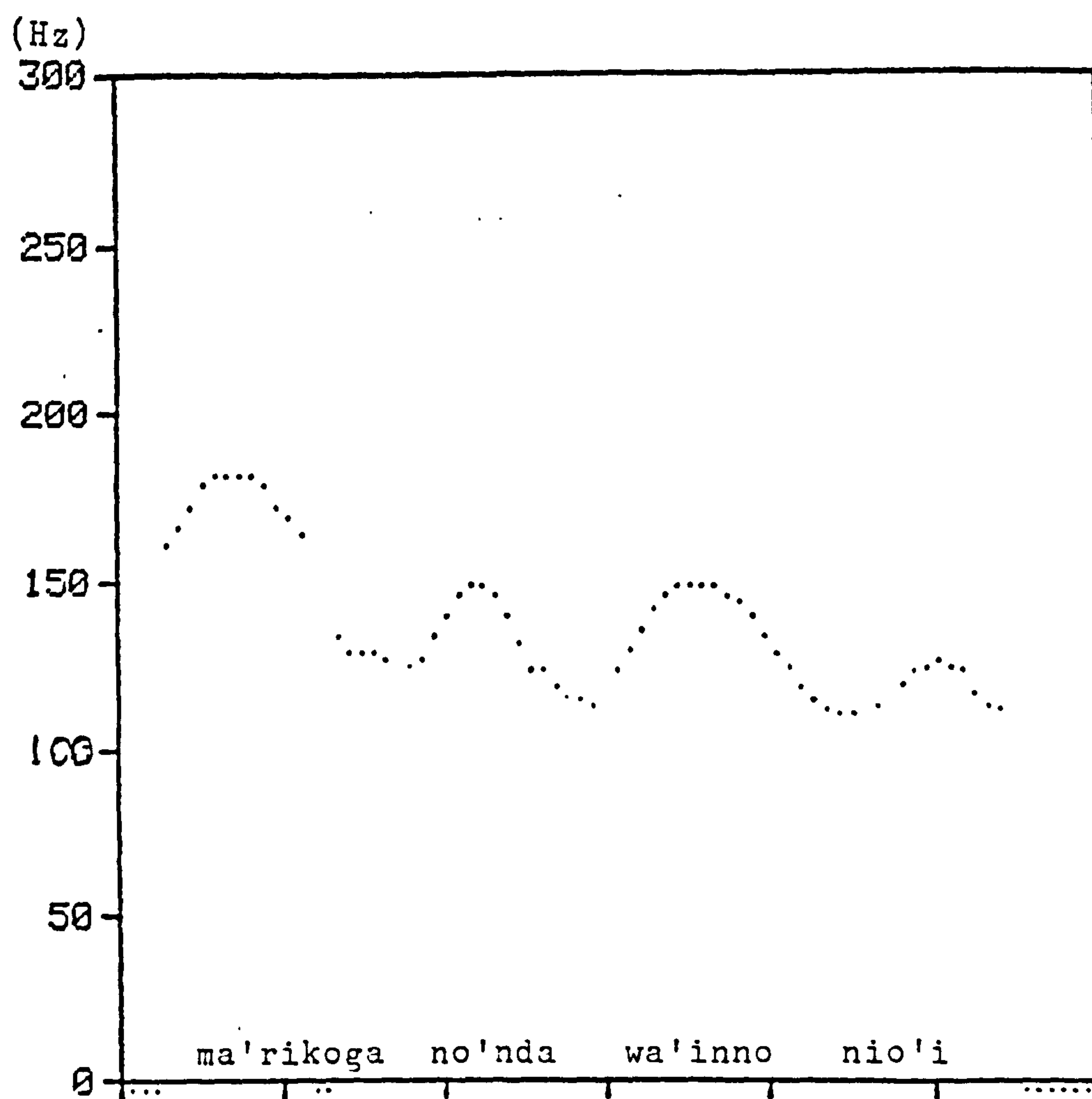


Figure 5.44

Dataset IX

++++

(H₂)

180

150

120

~

v_1 p_1 v_2 p_2 v_3 p_3 v_4 p_4 v_5

Figure 5.45

Dataset IX

++++

(H₂)

180

150

120

~

v_1 p_1 v_2 p_2 v_3 p_3 v_4 p_4 v_5

Figure 5.46

Dataset IX

++++

++++

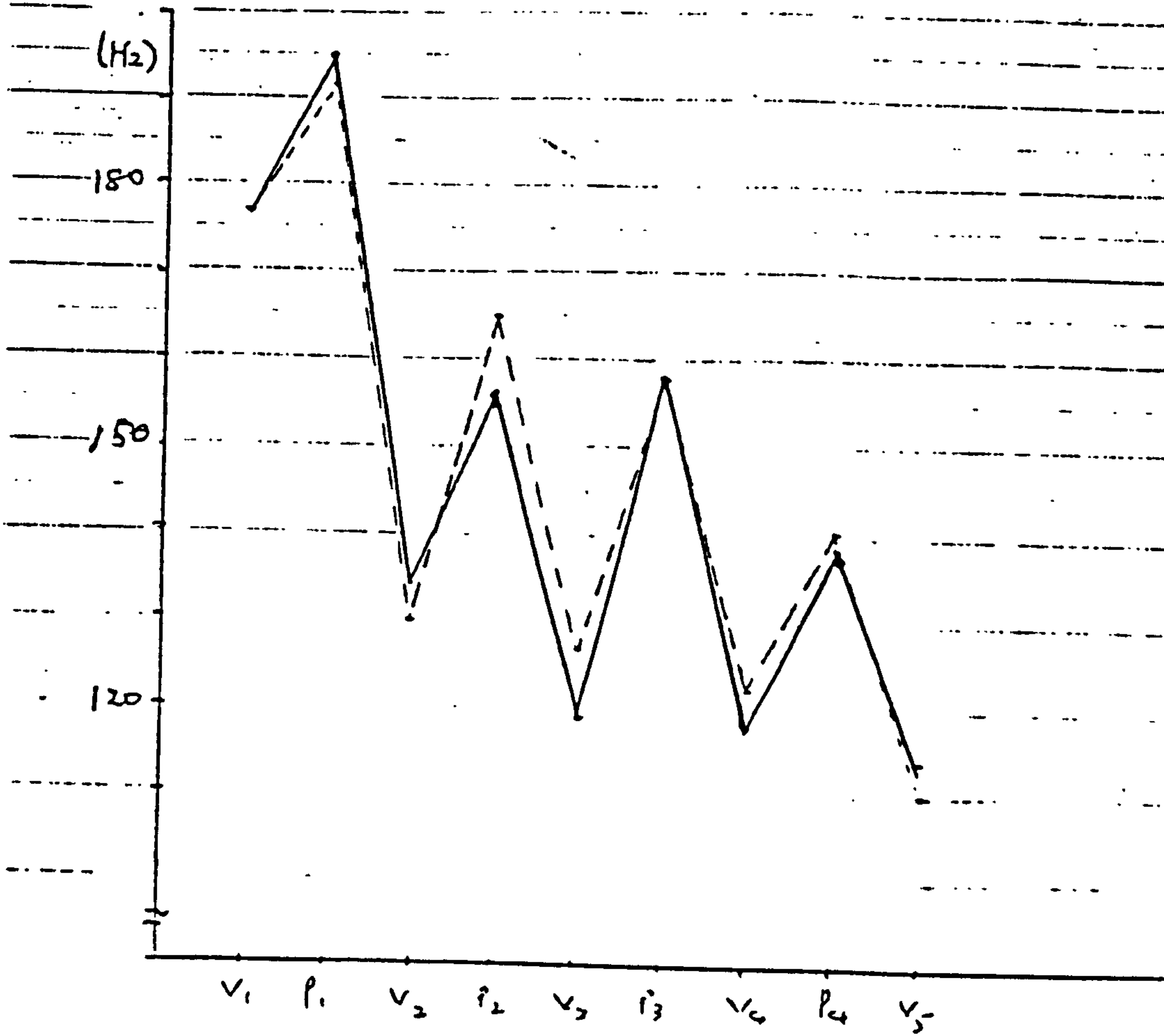


Figure 5.47

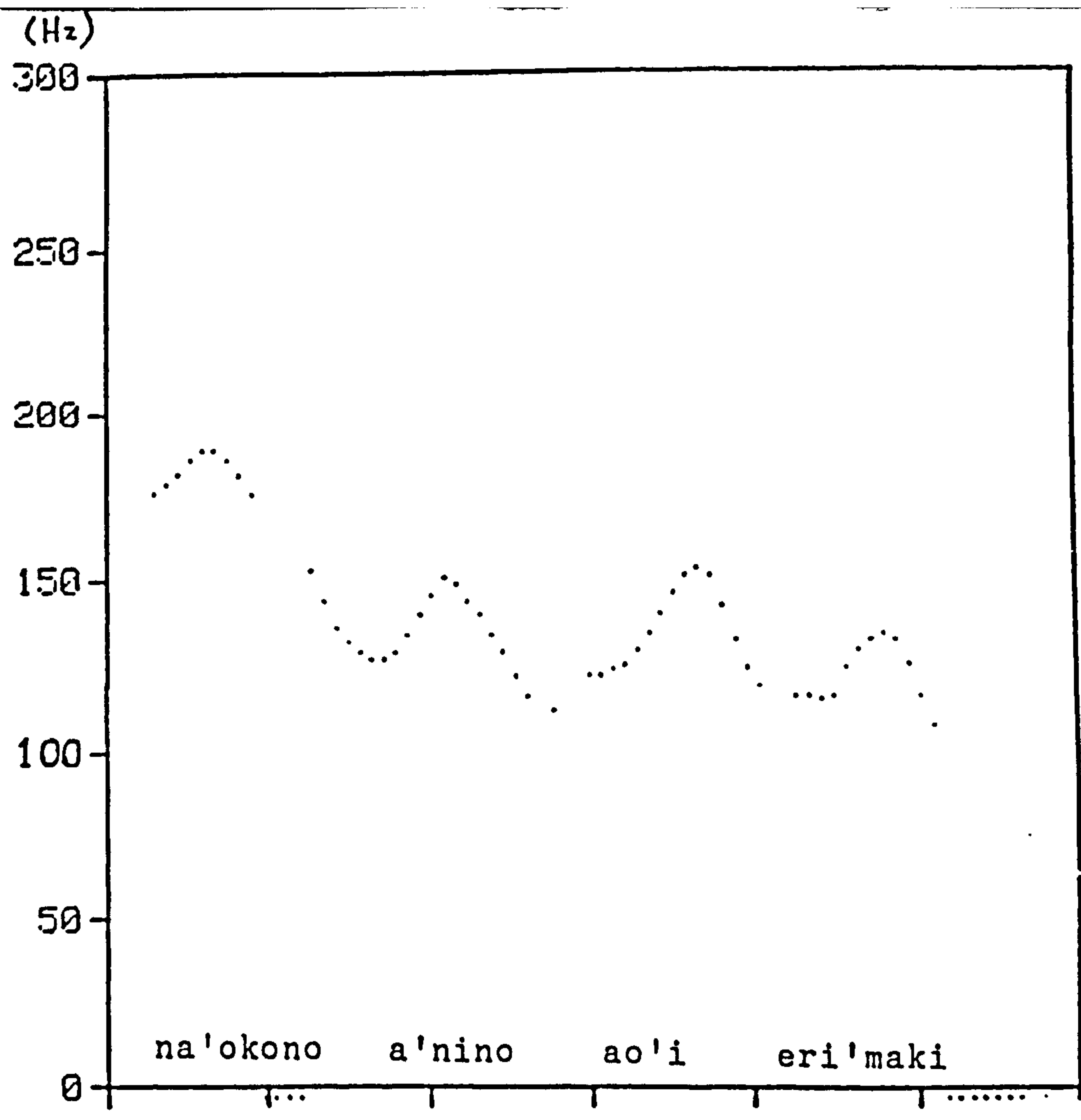


Figure 5.48

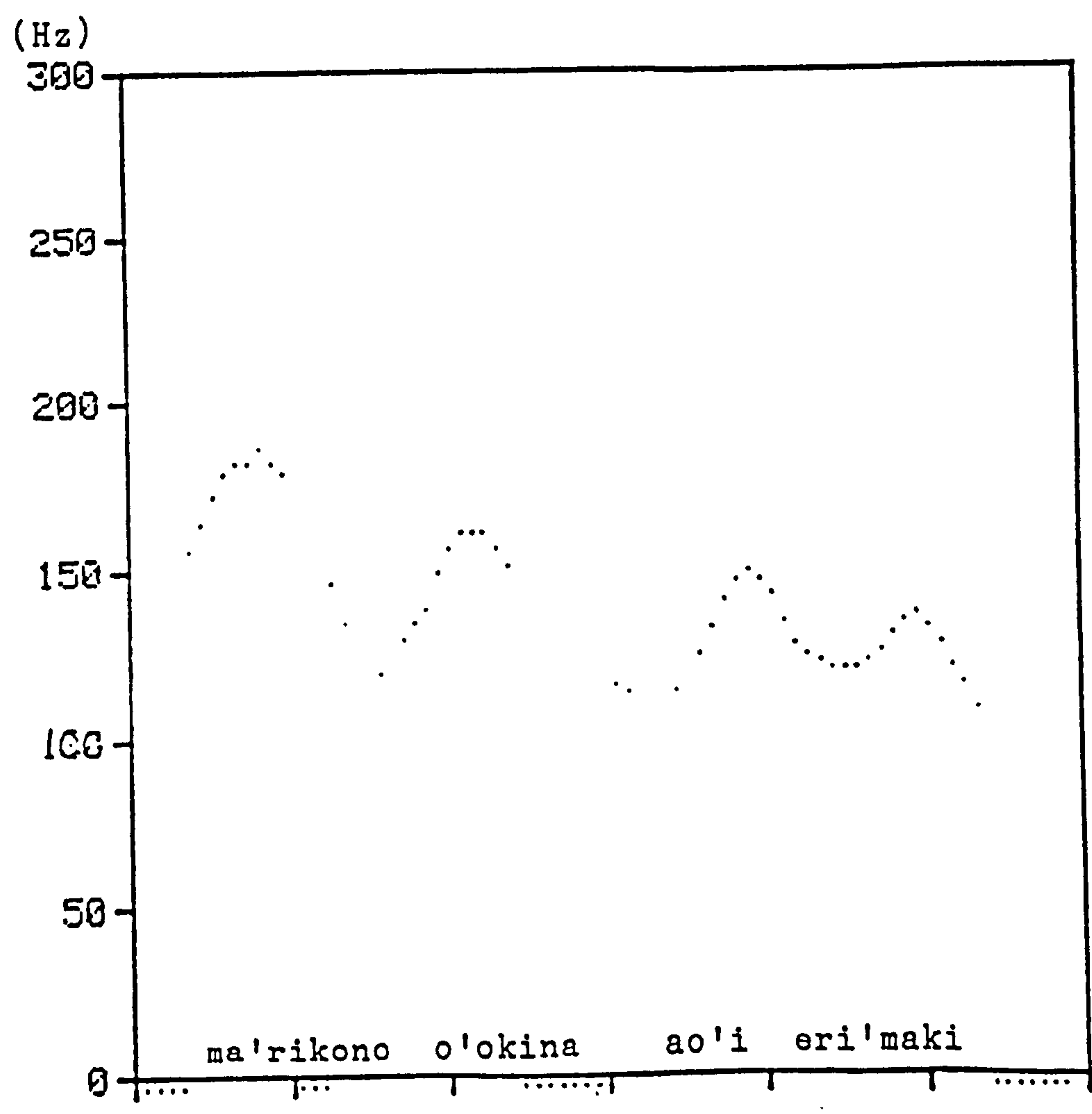


Figure 5.49

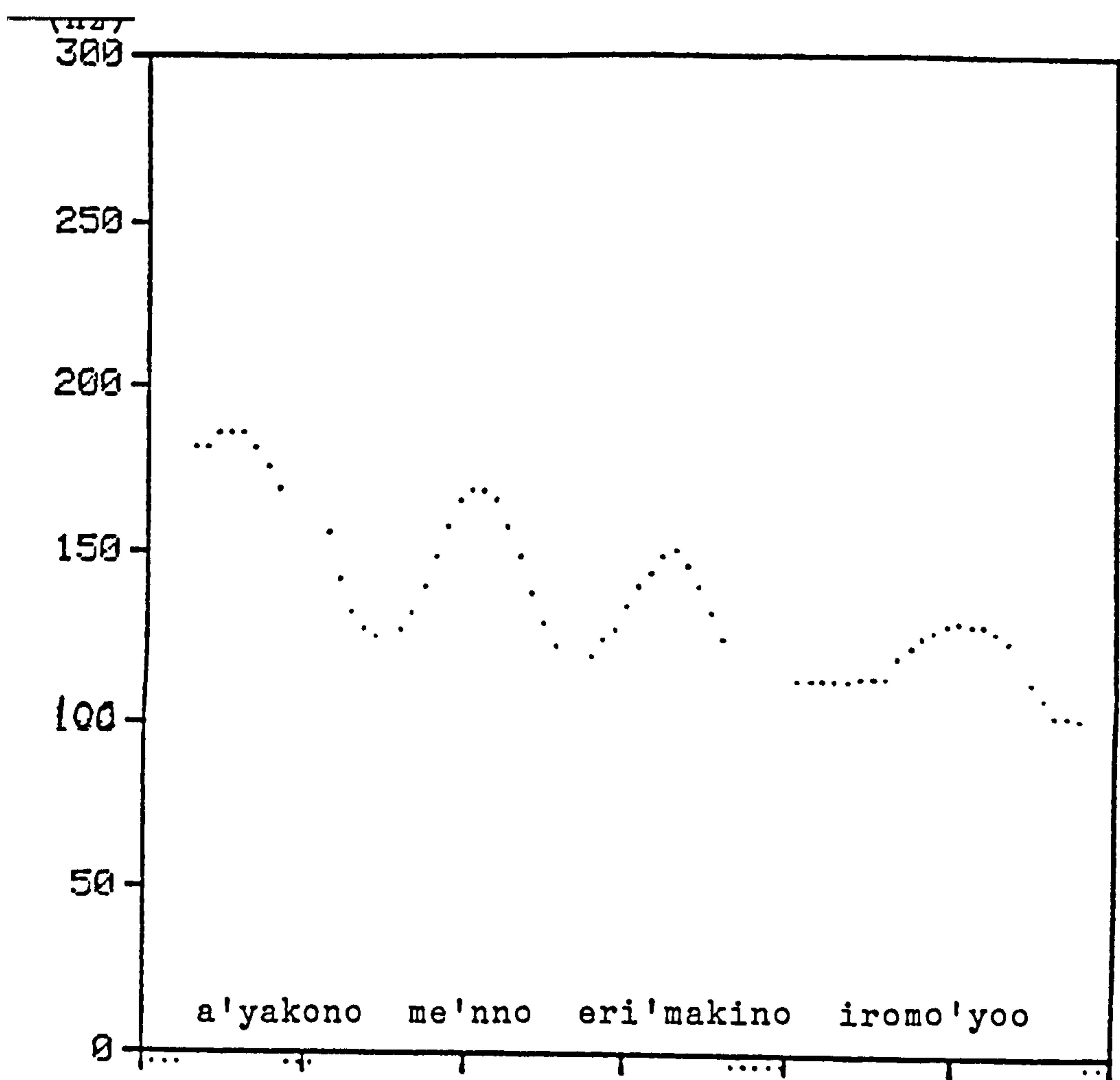


Figure 5.50

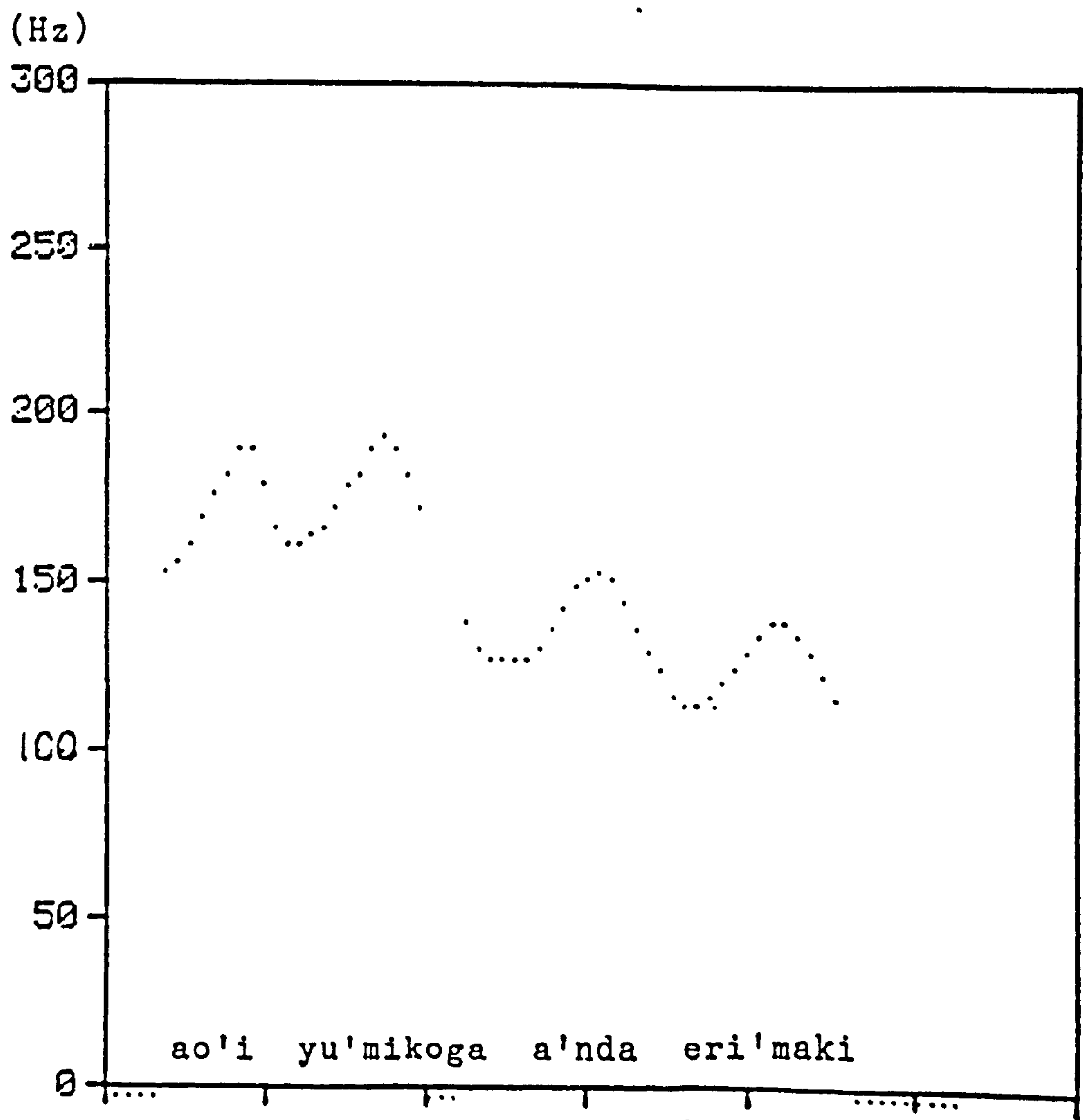


Figure 5.51

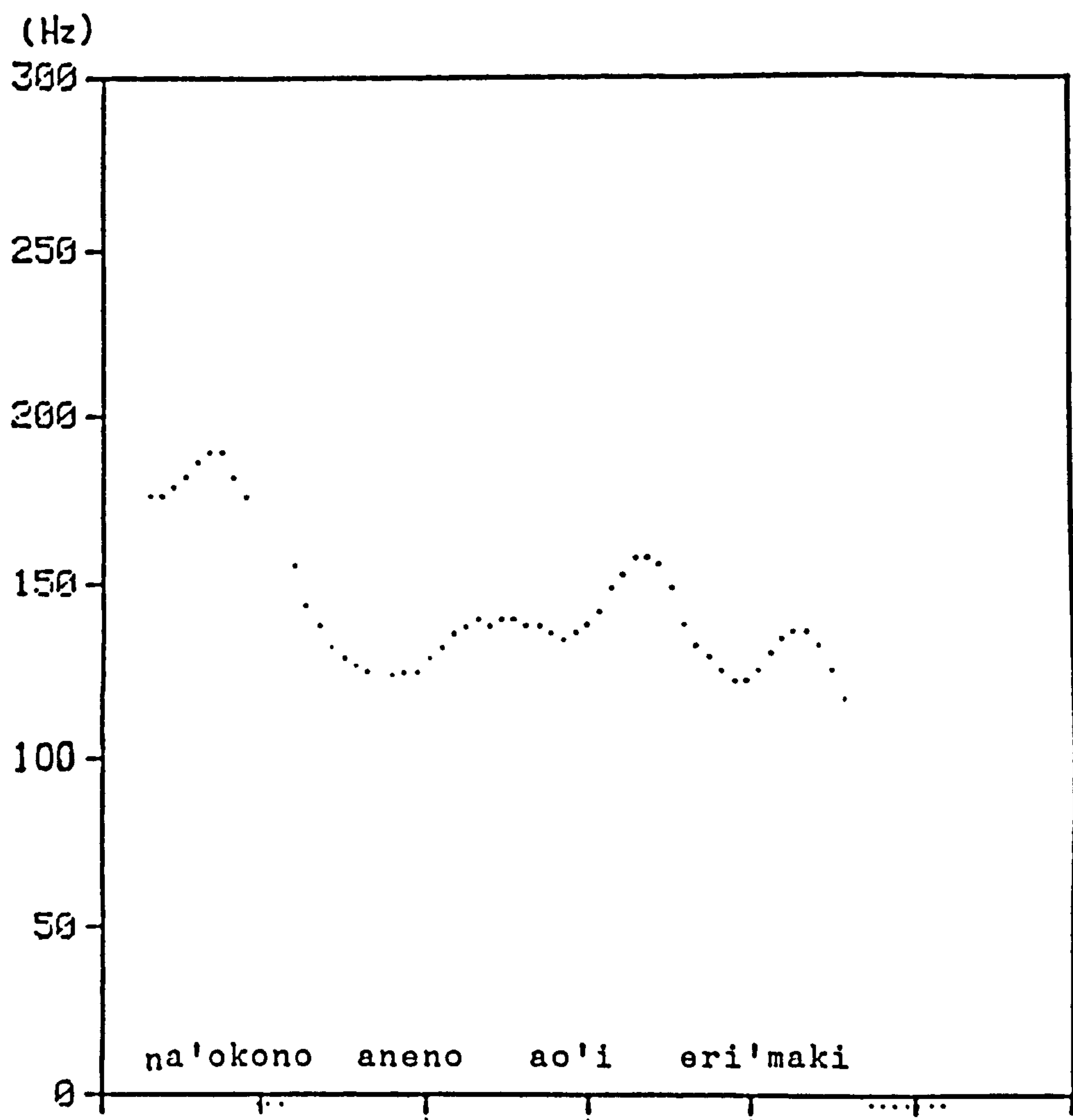


Figure 5.52

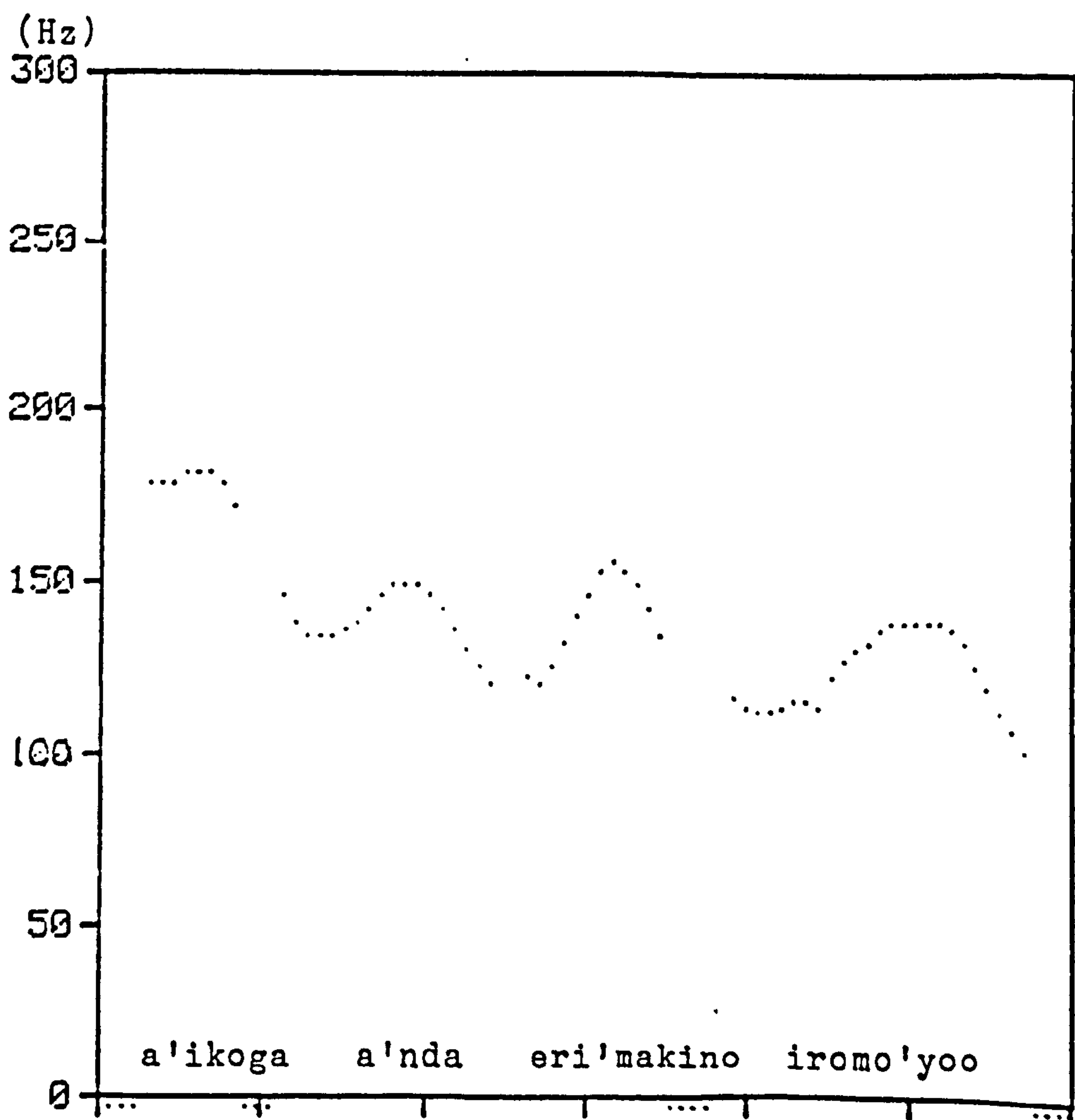


Figure 5.53

442554

(Hz)

(3)



200

150

100

V_1 P_1 V_2 P_2 V_3 P_3 V_4 P_4 V_5

Dutast X

—

- - -



āyākoni
aō'i

mē'no
yūnibuga

eitmakine
a'ndu

ir-nōgoc
eitmeki

200

150

5.35

100

V_1 P_1 V_2 P_2 V_3 P_3 V_4 P_4 V_5

57.5

Dataset X

— + + + +

na⁷okono

a⁷nino

ao⁷i

ma⁷huraa

- - - + - + +

na⁷okono

aneno

ao⁷i

ma⁷huraa

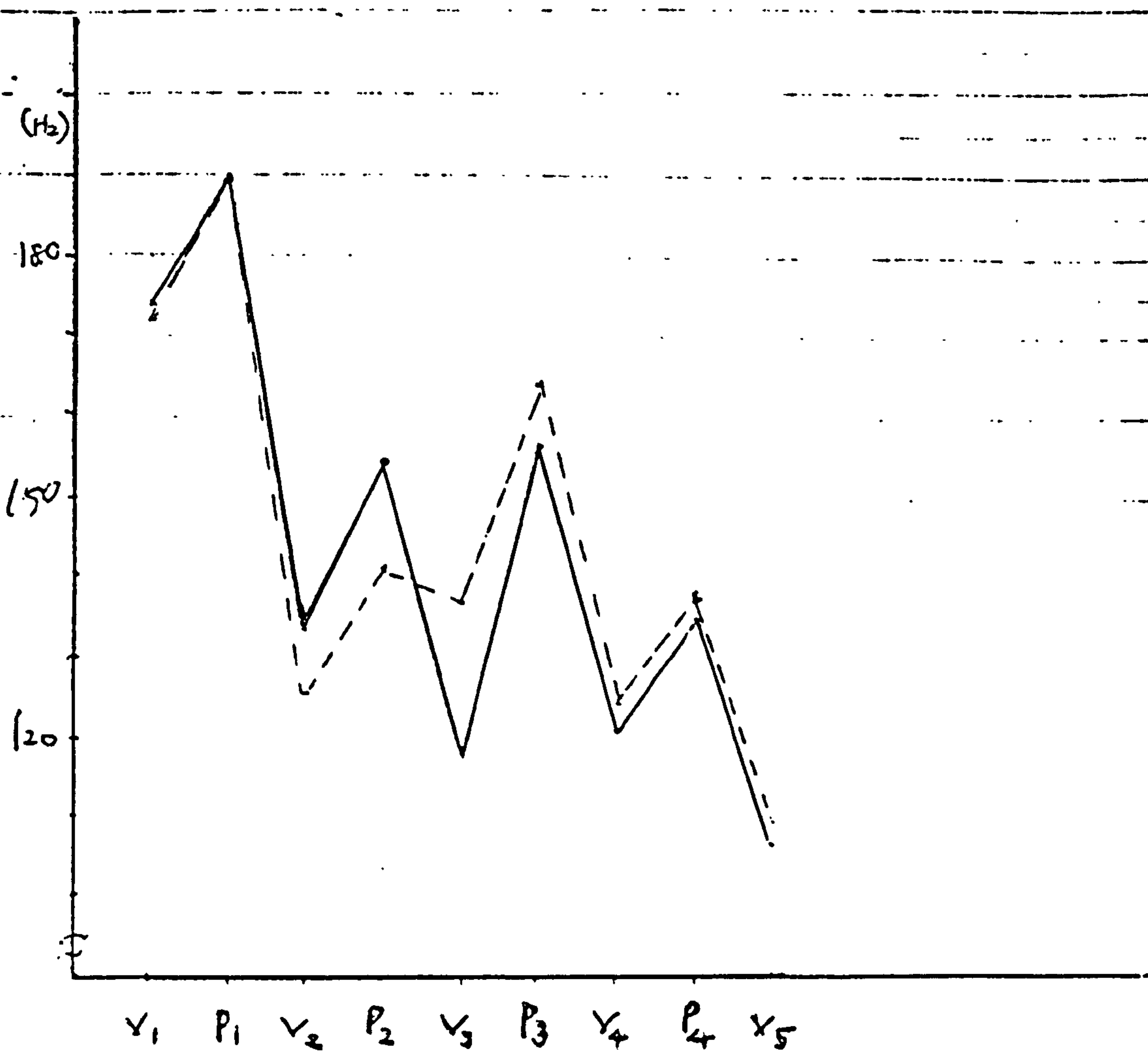


Figure 5.56

Dataset 1X

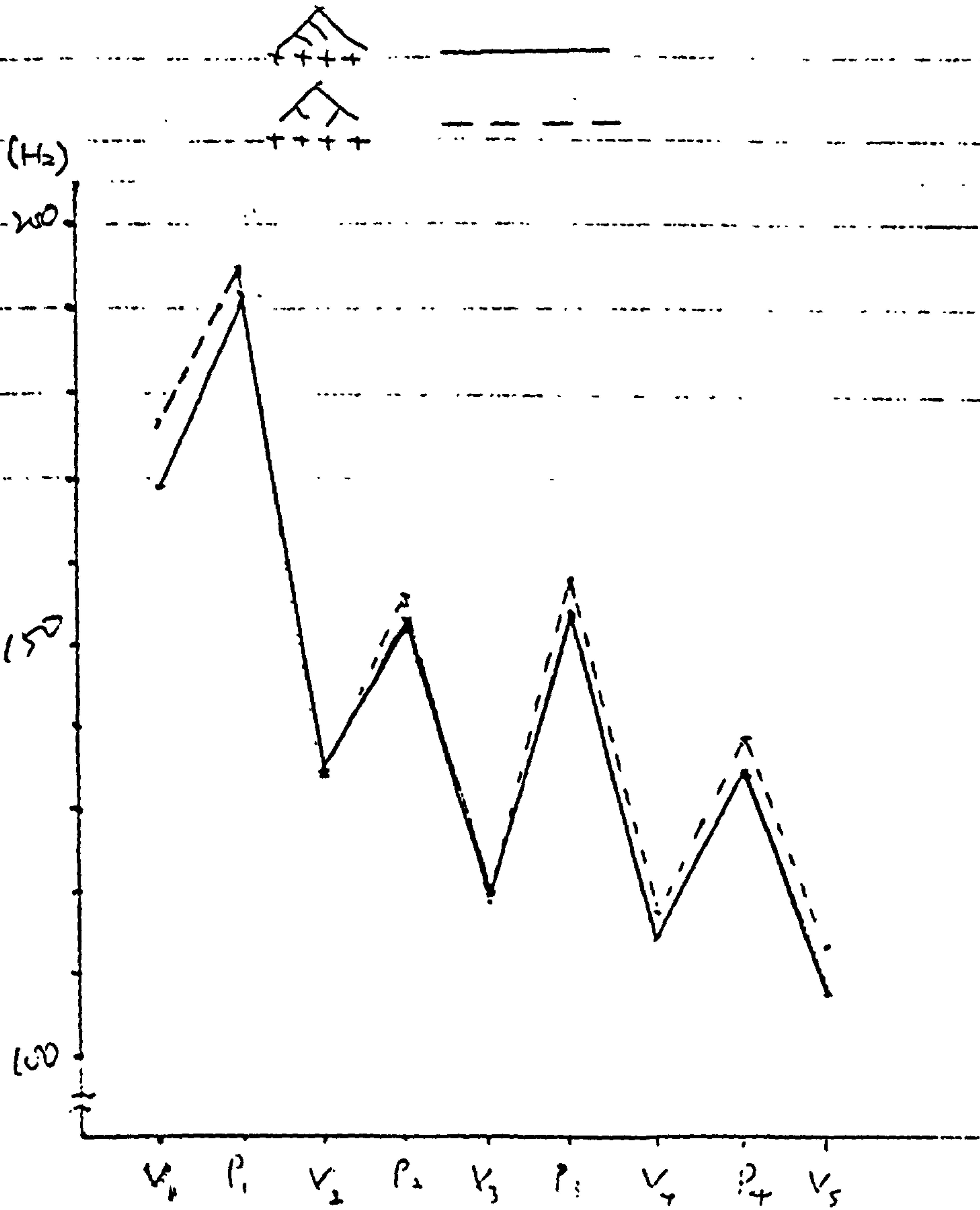
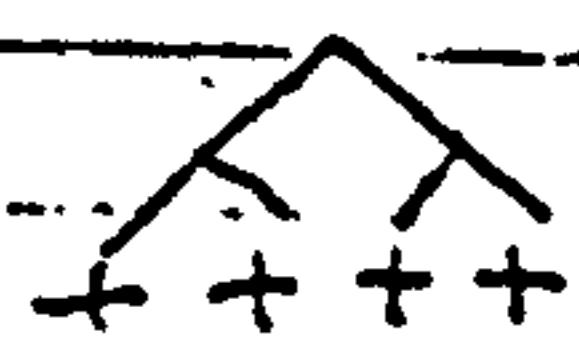


Figure 5.57

Dataset X



ā'ikoge ānda erimakinō iromōyoo



nāokono ānino aō'i-erimaki

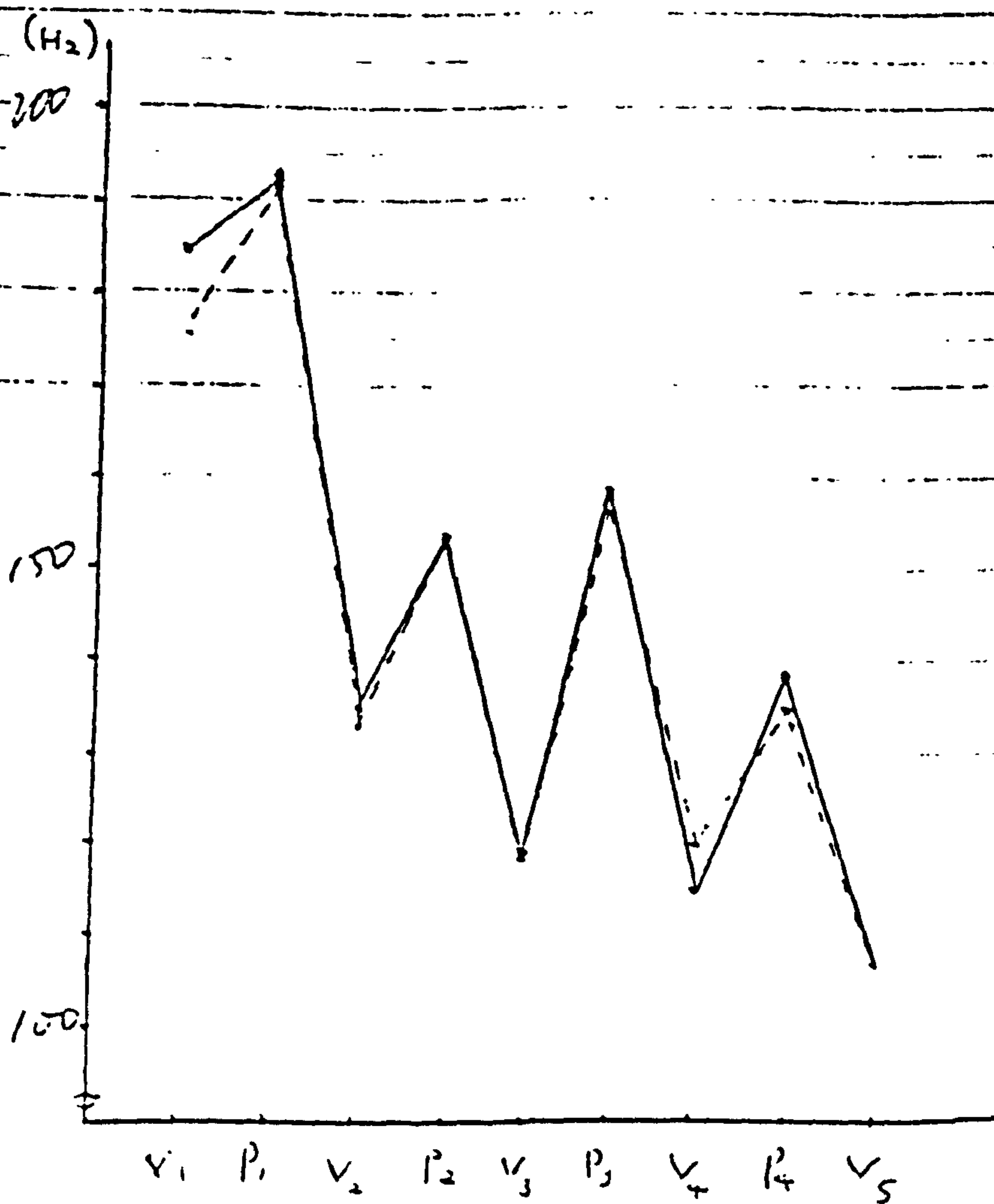


Figure 5.58

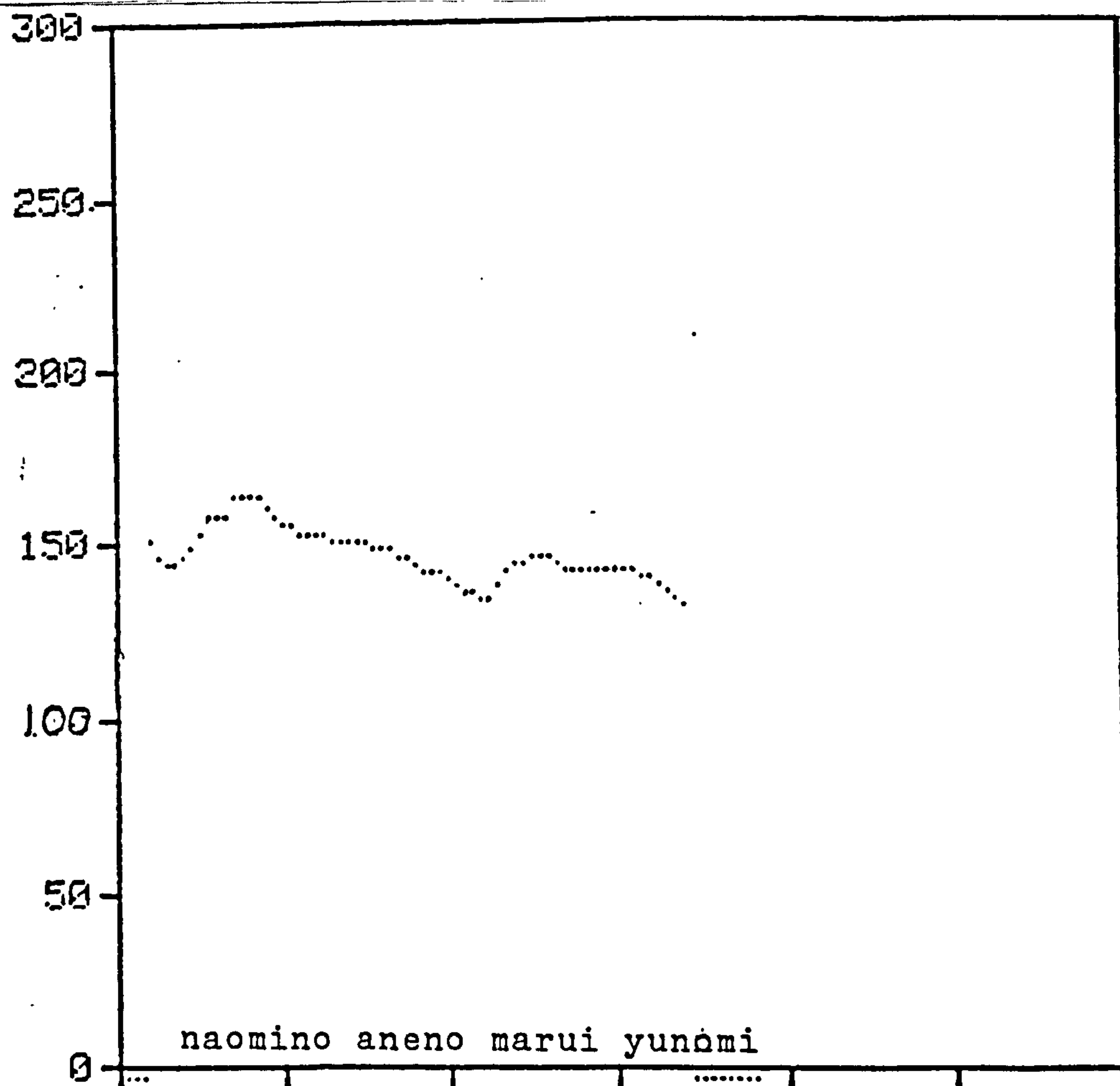


Figure 5.59

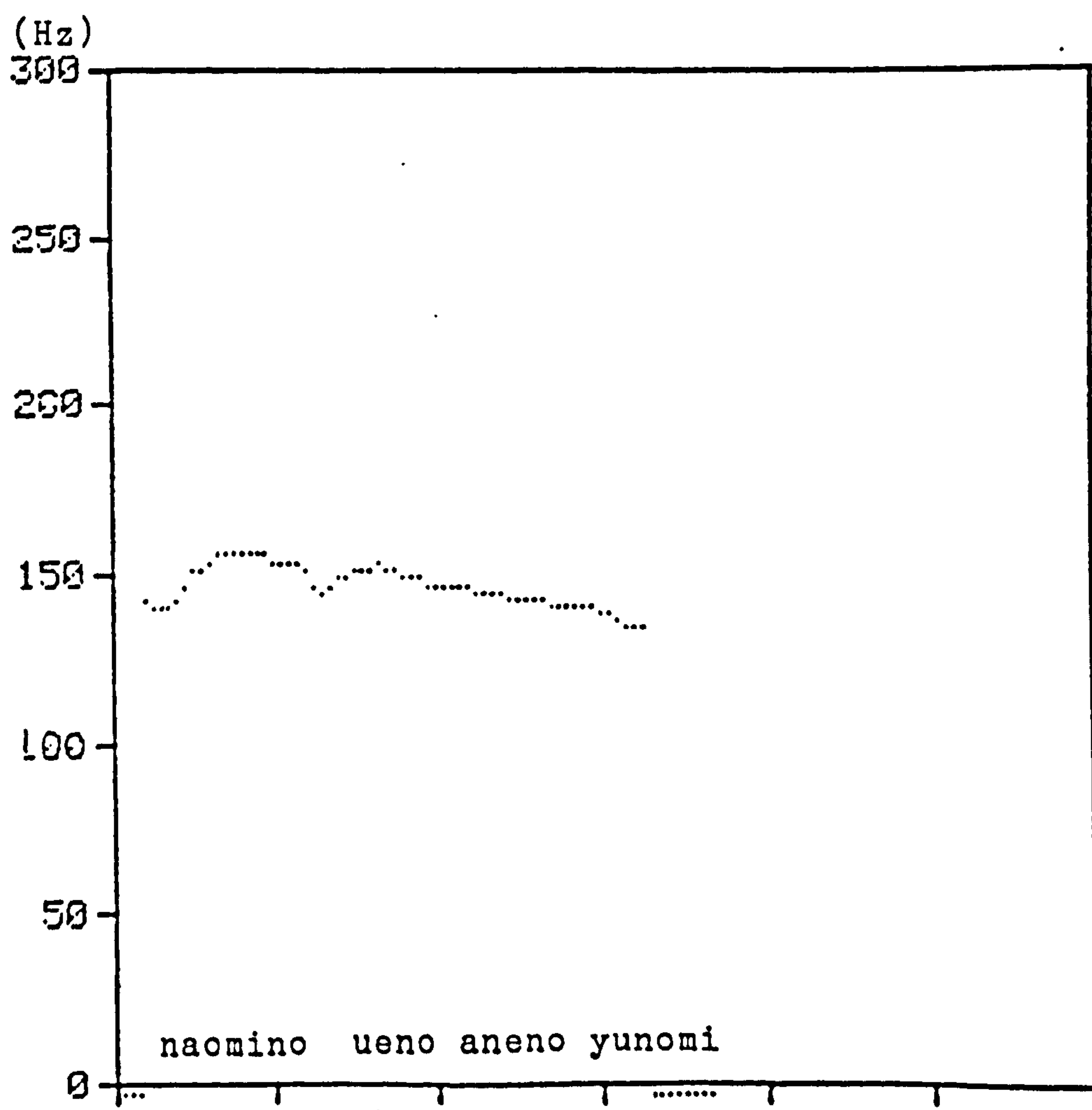


Figure 5.60

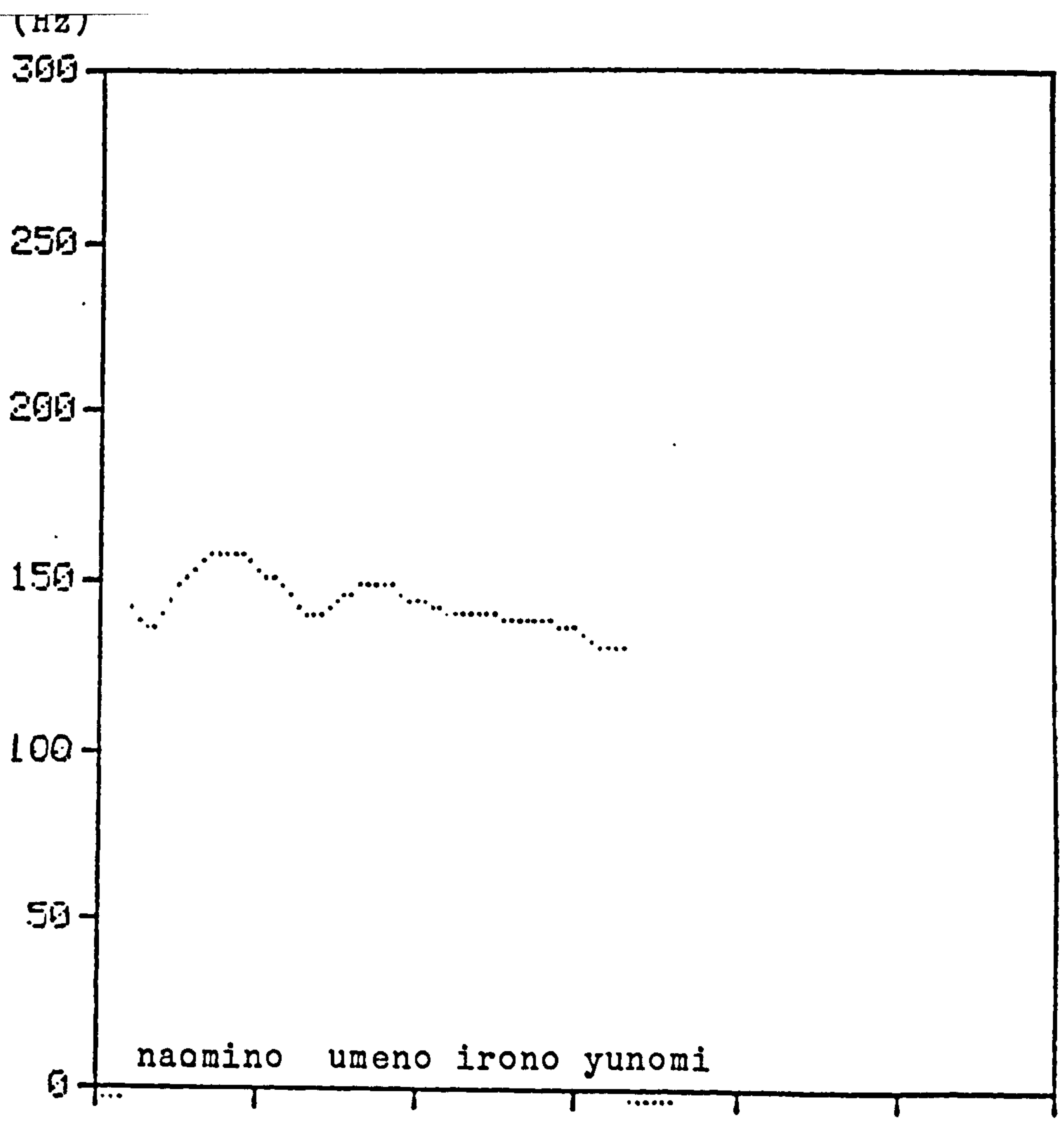


Figure 5.61

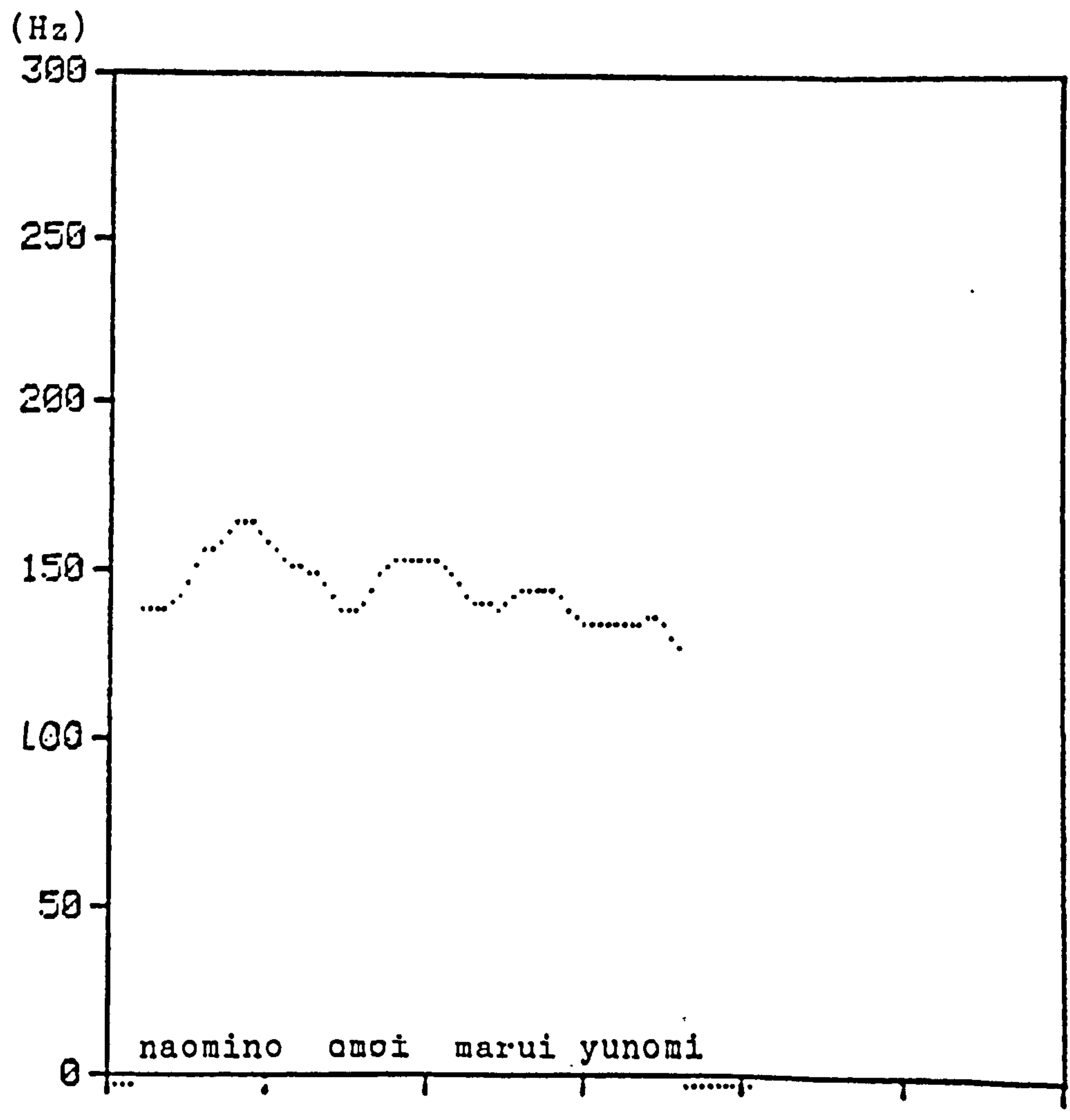
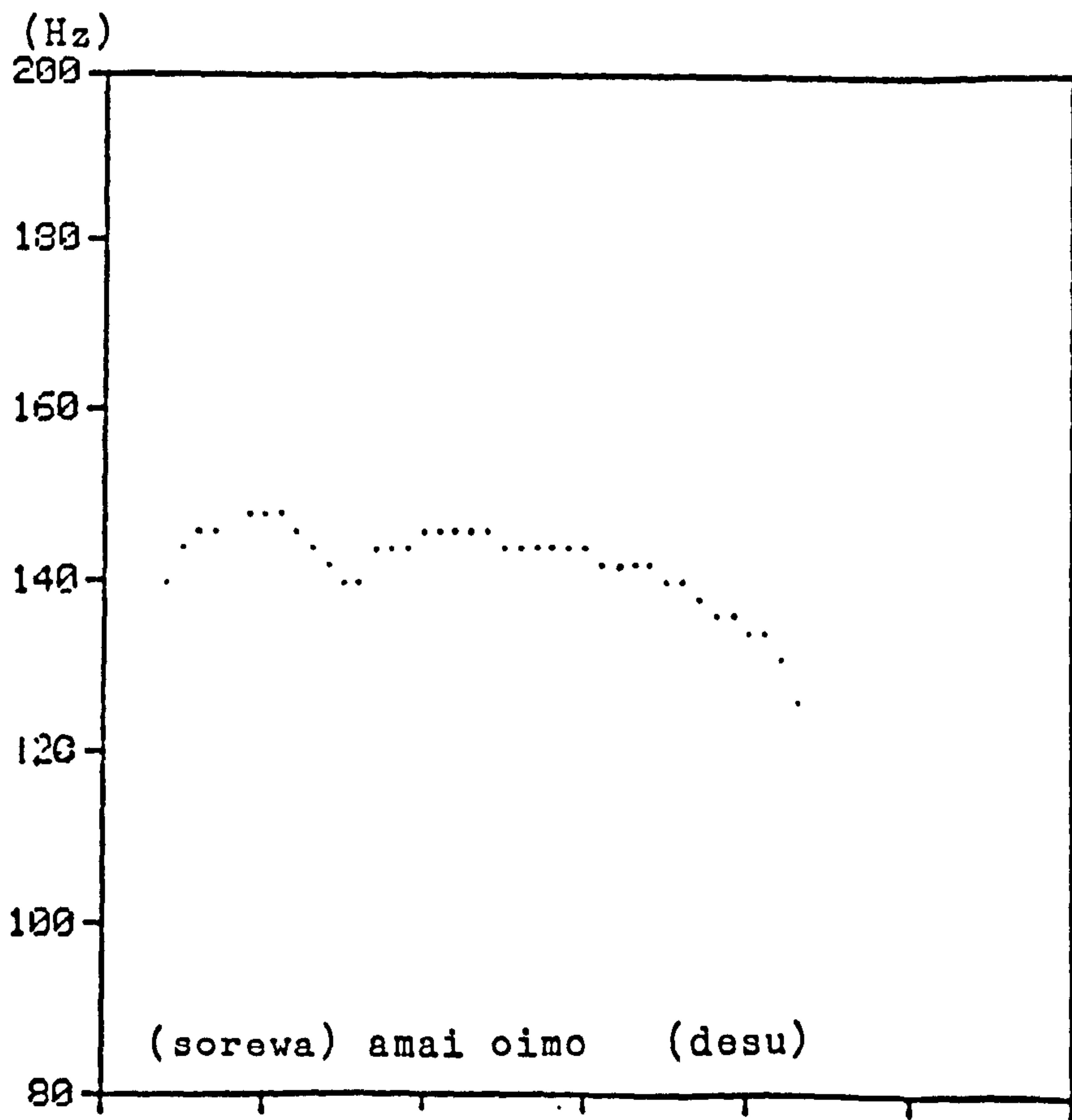
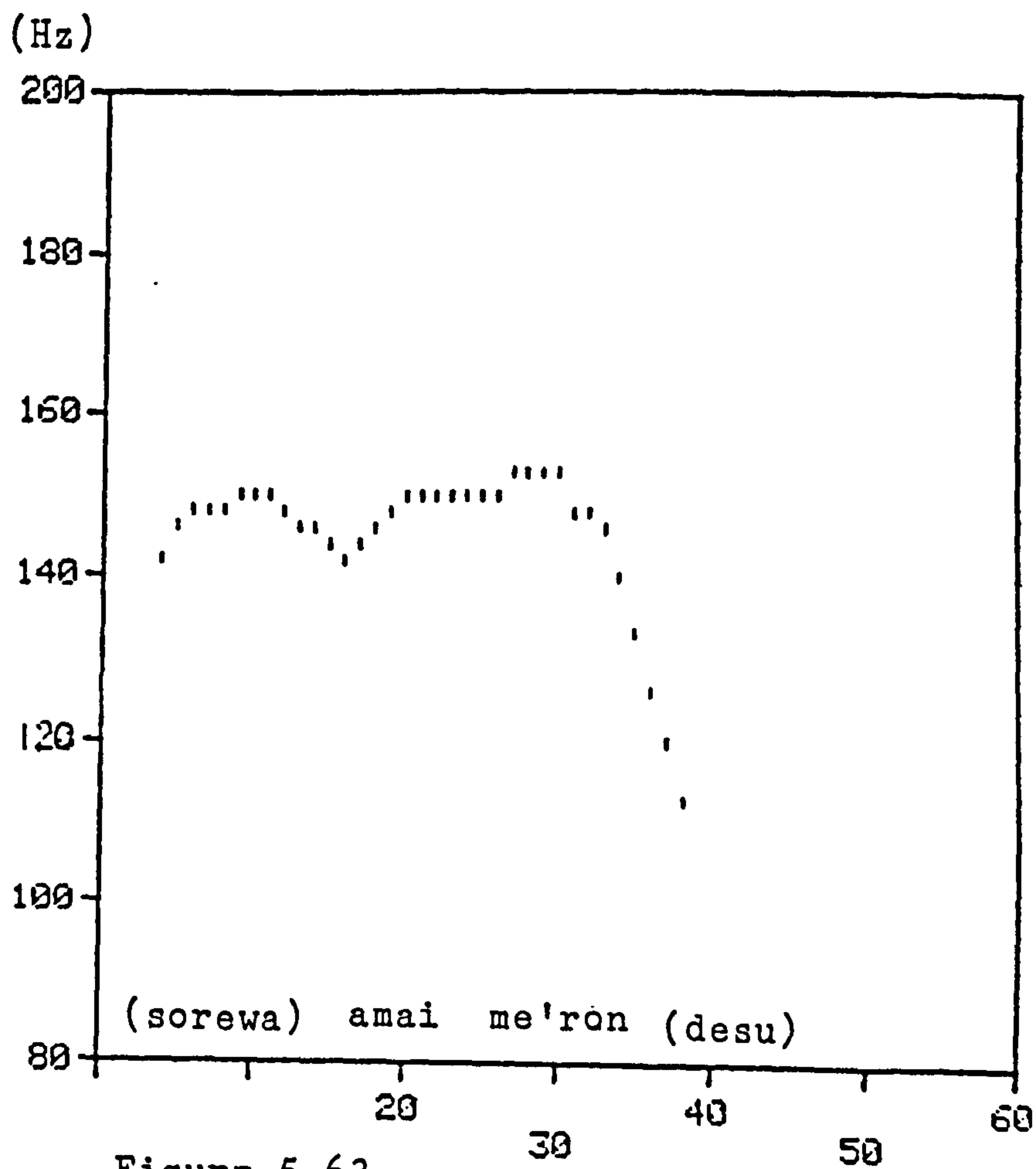


Figure 5.62



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APPENDIX I: DATASETS

To simplify description, the following abbreviations and notations are used:

- /'/ : word accent
- 'Acc' : the accusative particle o
- 'Nom' : the nominative particle ga
- 'Sub' : the subjunctive form of verbs
- 'Top' : the topic particle wa
- 'Null' : a semantically null particle mo
- 'Neg' : a negative particle
- 'Emp' : an emphatic adverb

Dataset I

Dataset I consists of the following seven sentences written in one set of cards. The cards were put in the frame naomi wa ... to itta "Naomi said that ..." and was read a total of ten times in separate blocks. Since the primary purpose of this experiment was not to measure F0 values but to examine the overall shapes of the F0 contours, the cards were not reshuffled between the repetitions. For the same reason, all the ten blocks were subsequently analyzed without the first block discarded.

1. na'ni-o no'ndara i'i-desu-ka

"What-Acc" "drink(Sub)" "good-be-Q"
= "What would it be best to drink?"

2. o'oman-made aru'ita

"Oman-to" "walked" = "(she) walked to Oman."

3. i'ran-yori i'raku-ga suki'-da

"Iran-than" "Iraq-Nom" "like"
= "(she) likes Iraq better than Iran."

4. na'ni-o yo'ndara i'i-desu-ka

"what-Acc" "read(Sub)" "good-be-Q"
= "What would it be best to read?"

5. muro'ran-made aru'ita
 "Muroran (placename)-to" "walked"
 = "(she) walked to Muroran"
6. ro'oma-yori mi'rano-e mukatta
 "Rome-from" "Milan-to" "headed"
 = "(she) headed for Milan from Rome"
7. ramune-o no'nde-mi'ru
 "lemonade-Acc" "drink-see"
 = "(she) tries drinking lemonade"

Dataset II

This dataset contains the ten test sentences listed below. Like the sentences in Dataset I, these sentences were written in one set of cards and were read ten times in separate blocks in the phrase sentence naomi-wa ... to itta "Naomi said that" All the ten repetitions were subsequently analyzed.

1. mayumi-ga ka'eru-ma'de ie'-ni iru
 "Mayumi-Nom" "return-till" "home-at" "be"
 = "(she) will be at home until Mayumi returns"
2. noruwe'e-yo'ri-mo ruumania-no ho'o-ga suki'da
 "Norway-than-Null" "Romania-Gen" "side-Acc" "like"
 = "(she) likes Romania better than Norway"
3. mayumi-ga no'nde-mi'ru-ma'de no'mu-na
 "Mayumi-Nom" "drink-see-till" "drink-Neg"
 = "Do not drink (it) until Mayumi tries drinking (it)"
4. mayumi-wa ie'-ni iru-yo'oda
 "Mayumi-Top" "home-at" "be-look"
 = "It looks Mayumi is at home"
5. mayumi-wa ayama'ru-daro'o
 "Mayumi-Top" "aplogize-will"
 = "Mayumi will apologize"

6. ruumania-yo'ri noruwe'e-ma'de aru'ita

"Romania-from" "Norway-to" "walked"
= "(she) walked from Romania to Norway"

7. kono ra'nnaa-yori-mo ano ra'nnaa-no ho'o-ga
"this" "runner-than-Null" "that" "runner-Gen" "side-Nom"

asi'-ga haya'i
"leg-Nom" "fast"

= "that runner runs faster than this runner"

8. tegami-o yo'nde-mi'ru-no'de moo sukosi ma'tte kudasa'i

"letter-Acc" "read-see-as" "more" "bit" "wait" "please"
= "please wait for a little more as I will try reading
the letter"

9. asu'-wa hare'ru-daro'o

"tomorrow-Top" "clear up-will"
= "It will be a nice day tomorrow"

10. mayumi-ga yo'mu-yo'o-ni yomi-nasa'i

"Mayumi-Nom" "read-manner-in" "read-do"
= "read in the manner Mayumi reads"

Dataset III

This dataset consists of only two sentences given below. The first of the two sentences is an interrogative sentence to which the second sentence answers. The nucleus of the first sentence differs from the first test sentence in Dataset I in that it involves an emphatic adverb ittai which plays the role of emphasizing the word immediately following it, that is, na'ni-o "what." These two sentences were repeated ten times, yielding ten blocks in all. All the recordings were subsequently analyzed.

1. naomi-wa ittai na'ni-o no'ndara i'i-desu-ka to kiita

"Naomi-Top" "Emp" "what-Acc" "drink(Sub)" "good-be-Q" "asked"
= "Naomi asked, what on earth will it be best to drink?"

2. mayumi-wa wa'in-o no'ndara i'i to kota'eta

"Mayumi-Top" "wine-Acc" "drink(Sub)" "good" "that" "answered"
= "Mayumi answered that it would be best to drink wine."

Dataset IV

This dataset consists of the five phrases given below, which all involve the same number of morae (thirteen morae). These phrases are all made up of four unaccented words or phrases. but differ in the syntactic structure they form. In recording, these phrases were written in two sets of cards which were read in the frame ka'rewa ... to itta "He said" The two sets of cards were read in turn six times each, yielding a total of twelve repetitions. All the repetitions but the first one were analyzed with the first one discarded as a practice session.

1. [[naomi-no ane-no][marui yunomi]]

"Naomi-Gen" "'sister-Gen" "round" "teacup"
= "Naomi's sister's round teacup"

2. [[naomi-no [ue-no ane-no]] yunomi]

"Naomi-Gen" "upper-Gen" "sister-Gen" "teacup"
= "Naomi's eldest sister's teacup"

3. [naomi-no [[ume-no iro-no] yunomi]]

"Naomi-Gen" "plum-Gen" "color-Gen" "teacup"
= "Naomi's plum-colored teacup"

4. [naomi-no [omoi [marui yunomi]]]

"Naomi-Gen" "heavy" "round" "teacup"
= "Naomi's heavy round teacup"

5. [[[naomi-no oi-no] yome-no] yunomi]

"Naomi-Gen" "nephew-Gen" "wife-Gen" "teacup"
= "Naomi's nephew's wife's teacup"

Dataset V

The fifteen phrases listed below all consist of two component phrases: a noun preceded by an adjective or by the sequence of a noun plus the genitive particle no. These test phrases vary in the accentedness, accent location and phonological length of the components. In accentual terms, they fall into four groups: the first eight phrases consist of two accented components; the next five phrases are made up of an accented component plus an unaccented one; and the last two phrases involve the sequence of an unaccented word followed by an accented and unaccented word respectively.

These test phrases were put into the frame sorewa ... desu "It is ...," and were written on one set of cards in pseudo-random order. In arranging the cards, special care was taken to avoid arranging any two phrases consecutively which share one of the component phrases so that no contrastive emphasis would be placed on any item. The cards were read a total of twelve times in separate blocks. Measurements were made of the second through twelve blocks recorded, with the first block discarded as a practice block.

1. uma'i me'ron	"tasty melon"
2. na'ma-no u'ni	"uncooked sea-urchin"
3. o'okina me'ron	"big melon"
4. yo'nmai-no o'obaa	"four overcoats"
5. o'onosan-no i'rui	"Mr Ohno's clothes"
6. uma'i nomi'mono	"tasty drink"
7. nau'i iromo'yoo	"fashionable design"
8. uma'i maamare'edo	"tasty marmalade"
9. uma'i oimo	"tasty potato"
10. na'ma-no oimo	"uncooked potato"
11. o'okina oimo	"big potato"
12. yo'nmai-no nurie	"four drawings"
13. o'onosan-no namae	"Mr Ohno's (given) name"
14. amai me'ron	"sweet melon"
15. amai oimo	"sweet potato"

Dataset VI

This dataset consists of six pairs of phrases which differ in the accentedness of the first or second component. As in Dataset V, all the test phrases in this dataset consist of two component words or phrases, and were recorded in the sentence frame sorewa ... desu "It is" Unlike Dataset V, the sentences were copied onto five sets of cards, but they were arranged in a pseudo-random order as in Dataset V. Twelve recordings of each sentence were made, with some sets of cards read twice, others three times. The first recordings were discarded, leaving eleven tokens of each sentence for subsequent analysis.

1. uma'i nomi'mono	"tasty drink"
2. uma'i yamaimo	"tasty yam (potato)"
3. amai nomi'mono	"sweet drink"
4. amai yamaimo	"sweet yam"
5. na'oko-no o'obaa	"Naoko's overcoat"
6. naomi-no o'obaa	"Naomi's overcoat"
7. na'oko-no eri'maki	"Naoko's muffler"
8. naomi-no eri'maki	"Naomi's muffler"
9. na'oko-no omamori	"Naoko's amulet (charm)"
10. naomi-no omamori	"Naomi's amulet"
11. omoi ya'mai	"grave disease"
12. omoi yoroi	"grave armor"

Dataset VII

This dataset comprises 120 test phrases each of which consist of three component words or phrases. The first two of these components are adjectives or adjectival phrases (i.e. a noun plus the genitive no) while the last component is a noun. These test phrases fall into two types in syntactic terms: one-third of them involve a right-branching structure, just like the English phrase John's three daughters while the remaining two-thirds involve a left-branching structure, just like John's daughter's book. Left-branching phrases are further divided into two groups depending on the degree of the semantic relatedness between the two components in the inner constituent: 'loosely-bound' phrases, in which the two components are semantically rather independent so that the second component can form a meaningful phrase without the first one (e.g. John's daughter's book, daughter's book), and 'tightly-bound' phrases, in which those two components form such a close-knit unit that the omission of the first word simply leaves a nonsense phrase (e.g. two-tailed dog, *tailed dog).

In accentual terms, there are eight accentual patterns which phrases consisting of three components can potentially take. If we denote accented and unaccented components by [+A] and [-A] respectively, these eight accentual combinations can be expressed as follows:

(1)

[+A,+A,+A], [-A,+A,+A], [+A,-A,+A], [-A,-A,+A]
[+A,+A,-A], [-A,+A,-A], [+A,-A,-A], [-A,-A,-A]

The 120 test phrases all involve an accented word as the third component and, hence, take one of the first four accentual patterns in (1). In combination with the tripartite classification mentioned above, this accentual classification divides the whole set of test phrases into twelve groups, each consisting of eight to twelve phrases. The following list illustrates this with some typical examples from the set.

1. Right-Branching Phrases

a) [+A,+A,+A]: [kowa'i [me'no ya'mai]]

"fearful" "eye-Gen" "disease"
= "fearful eye disease"

b) [-A,+A,+A]: [kiroi [me'nno ori'mono]]

"yellow" "cotton-Gen" "fabric"
= "yellow cotton fabric"

c) [+A,-A,+A]: [ao'i [momenno ori'mono]]

"blue" "cotton-Gen" "fabric"
= "blue cotton fabric"

d) [-A,-A,+A]: [amai [marui me'ron]]

"sweet round melon"

2. Loosely-Bound Left-Branching Phrases

a) [+A,+A,+A]: [[na'mano a'yuno] nio'i]

"raw" "ayu (fish)-Gen" "smell"
= "smell of raw ayu"

b) [-A,+A,+A]: [[naomino ne'esanno] i'yaringu]

"Naomi-Gen" "sister-Gen" "earring"
= "Naomi's sister's earring"

c) [+A,-A,+A]: [[na'mano yamaimono] nio'i]

"raw" "yam (potato)-Gen" "smell"
= "smell of raw yam"

d) [-A,-A,+A]: [naomino aneno] eri'maki]

"Naomi-Gen" "sister-Gen" "muffler"
= "Naomi's sister's muffler"

3. Tightly-Bound Left-Branching Phrases

a) [+A,+A,+A]: [['warena mi'narino] o'yako]

"poor" "appearance-Gen" "parent & child"
= "a poorly dressed family"

b) [-A,+A,+A]: [[kiroi ya'nenno] ie'ie]

"yellow" "roof-Gen" "houses"
= "houses with a yellow roof"

c) [+A,-A,+A]: [[nau'i moyoono] eri'maki]

"trendy" "design-Gen" "muffler"
= "a muffler of a trendy design"

d) [-A,-A,+A]: [[amai neirono] o'ngaku]

"sweet" "tune-Gen" "music"
= "sweet-tuned music"

The 120 test phrases were written on one set of cards. These cards were arranged in a pseudo-random order with special care taken not to arrange consecutively any two cards which

include an identical word. To make this arrangement easier, some dummy phrases were inserted every ten to fifteen phrases. Moreover, a half dozen dummy phrases were put at the beginning of the set so that the recording can be started without any practice session. The test phrases and dummy phrases thus prepared were read in the frame Sorewa ... desu. "It is ..." Each card was read just once, and all the recordings (except those of the dummy phrases) were subsequently analyzed.

Dataset VIII

This dataset consists of the four pairs of test phrases listed below, all of which are made up of three words or simplex phrases. The two test phrases of each pair have identical accentual structure and similar tonal structure, but differ in syntactic structure. These test phrases and some dummy phrases were written in one set of cards, and were arranged in a random order. Dummy phrases were inserted between two phrases which happened to share an identical word. Test phrases thus prepared were read in the frame sorewa ... desu "It is ..." a total of twelve times. The first recordings were discarded and the remaining eleven recordings were subsequently analyzed.

1. a) [ao'i [o'okina me'ron]]
"blue" "big" "melon" = "an unripe big melon"
- b) [[ao'i re'monno] nio'i]
"blue" "lemon-Gen" "smell"
= "smell of an unripe lemon"
2. a) [o'okina [omoi me'ron]]
"big" "heavy" "melon" = "a big, heavy melon"
- b) [[o'okina mimino] o'okami]
"big" "ear-Gen" "wolf" = "a wolf with big ears"
3. a) [na'rano [yuumeina ryo'ori]]
"Nara (placename)-Gen" "famous" "dishes"
= "famous dishes of Nara"
- b) [[na'rano omiyano] eha'gaki]
"Nara-Gen" "shrine" "picturecard"
= "a picturecard of a shrine in Nara"
4. a) [na'rano [yuumeina omiya]]
"Nara-Gen" "famous" "shrine" = "a famous shrine in Nara"
- b) [[na'rano omiyano] omamori]
"Nara-Gen" "shrine-Gen" "amulet"
= "amulet of a shrine in Nara"

Dataset IX

This dataset consists of thirty-four phrases, some typical examples of which are given below, all consisting of four accented words (or simplex phrases). These phrases fall into three types depending upon the the consituent structure they form. These test phrases as well as a some dummy phrases were written in one set of cards. These cards were arranged in a random order with a few of the dummy phrases placed at the

beginning of the set. The phrases thus prepared were read just once, in the frame sorewa ... desu "It is ..." All the test phrases were subsequently analyzed.

1. [[a'ikono ne'esanno][u'uruno eri'maki]]

"Aiko-Gen" "sister-Gen" "wool-Gen" "muffler"
= "Aiko's sister's woolen muffler"

2. [yu'mino [ao'i [yuni'ikuna eri'maki]]]

"Yumi-Gen" "blue" "unique" "muffler"
= "Yumi's blue, unique muffler"

3. [[[ma'rikoga no'nda] wa'inno] nio'i]

"Mariko-Nom" "drank" "wine-Gen" "smell"
= "the smell of the wine which Mariko drank"

Dataset X

This dataset consists of the following six phrases. All these test phrase consist of four accented words (or simplex phrases) except the last one, which contains an unaccented word as the second word. Excepting this test phrase, all the other five phrases differ from each other primarily in the constituent structure they form. The first and last phrases have the same constituent structure, but differ in the accentedness of the second component.

The six test phrases were written on three sets of cards, in each of which they were randomly ordered. They were read in the frame karewa ... to itta "He said (that)..." One set of cards were repeated five times and the others four times, yielding a total of thirteen blocks of recordings. The first block was discarded as a practice session, and the remaining twelve blocks

were analyzed.

1. [[na'okono a'nino][ao'i eri'maki]]

"Naoko-Gen" "brother-Gen" "blue" "muffler"
= "Naoko's brother's blue muffler"

2. [ma'rikono [o'okina [ao'i eri'maki]]]

"Mariko-Gen" "big" "blue" "muffler"
= "Mariko's big, blue muffler"

3. [[a'ikono [me'nno eri'makino]] iromo'yoo]

"Aiko-Gen" "cotton-Gen" "muffler-Gen" "design"
= "the design of Aiko's cotton muffler"

4. [ao'i [[yu'mikoga a'nda] eri'maki]]

"blue" "Yumiko-Nom" "knit" "muffler"
= "the blue muffler (which) Yumiko knit"

5. [[[a'ikoga a'nda] eri'makino] iromo'yoo]

"Aiko-Nom" "knit" "muffler-Gen" "design"
= "the design of the muffler (which) Aiko knit"

6. [[na'okono .aneno][ao'i eri'maki]]

"Naoko-Gen" "sister-Gen" "blue" "muffler"
= "Naoko's sister's blue muffler"

APPENDIX II: KUBOZONO (1985)

"On the syntax and prosody
of Japanese compounds"

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ON THE SYNTAX AND PROSODY OF JAPANESE COMPOUNDS¹

Haruo Kubozono





INTRODUCTION

The purpose of this paper is three-fold. First, I will discuss the prosodic rules governing complex compound nouns in Japanese and show how they are conditioned by their constituent structures or syntax. Second, I will discuss two other prosodic phenomena to argue that the crucial role syntax plays in the prosodic compounding is of a rather general nature in the prosodic phonology of Japanese. And lastly, I will point out some theoretical implications and problems which my analysis presents.

Before going into the main argument, I will give a brief outline of 'accent' in Japanese². Japanese is often classified as a 'pitch accent' language as opposed to 'stress accent' languages like English (cf. Hyman 1975:230ff). What this classification means is not, as has often been supposed, that lexical accent in Japanese and English is signalled largely by a change in pitch (or fundamental frequency: Fo) and a change in amplitude, respectively. But rather it implies that phonetically the Japanese accent functions somewhat independently of other acoustic parameters like amplitude, duration or vowel quality while the English counterpart does not (cf. Beckman 1984). To be more specific, Japanese pitch accent is phonetically realized as a sudden pitch drop. A second feature of Japanese lexical accent is that its location is not entirely predictable from the linguistic information of the word and, therefore, must be specified in the lexicon. Thirdly, every word can have at most one accent, and the pitch contour of a word (pronounced in citation form) can be derived by rule, given the location of the accent. A fourth feature of Japanese pitch accent lies in the presence of unaccented content words, a feature which can possibly differentiate Japanese from other pitch-accent languages like Swedish where all content words are lexically accented (cf. Garding 1977). In statistical terms, unaccented words account for more than half of the whole vocabulary of Japanese, both content words (cf. Yokoyama 1979, cited in Miyajima et al. 1982:331)³ and function words, or the so-called 'particles' (cf. NHK 1966, Sanseido 1981:1278).

(1) describes these situations with three-mora nouns followed by a nominative particle 'ga' (ㇿ denotes the presence and location of accent, while — denotes absence of accent):⁴.

(1) Lexical Accent in Japanese

Accentedness:	Accented			Unaccented
Accentuation:	INITIAL	MEDIAL	FINAL	
Underlying Representation:	ihotiga 'life'	kokotoga 'heart'	otokoga 'man'	nezumiga 'mouse'
//Pitch/Tone Assignment Rules//				
Surface Pitch Representation:	ihotiga	kokotoga	otokoga	nezumiga
F ₀ Contour				

1. COMPOUND ACCENT RULE

Having looked at some major properties of lexical accent in Japanese, let us now consider the Japanese compound accent rule (CAR). Quite a few studies have been done on the accentuation of two-noun compounds, and they more or less agree on crucial points⁵. (2) shows the CAR proposed by McCawley (1977), with some typical examples in (3):

(2) Compound Accent Rule: McCawley (1977:272)

- a. In a noun compound X # Y, the accent of Y predominates.
- b. If Y is long (i.e. more than two morae long--HK) and final accented or unaccented, put the accent on the first syllable of Y.
- c. If Y is short and final-accented, deaccent the whole compound.

- (3) a. mōnbu dāzin → monbudāzin monbudazin 'education minister'
ookurā dāzin → ookuradāzin ookuradazin 'finance minister'
- b. inakā musumē → inakamūsume inakamusume 'country girl'
nōogyoo kumiai → noogyookūmiai noogyookumiai 'agricultural union'
roodoō kumiai → roodookūmiai roodookumiai 'labor union'
- c. huusen tama → huusendama huusendama 'balloon bead'

To be exact, the rules in (2) fail to account for some idiosyncratic cases

most of which are compounds with a short second element (cf. Higurashi 1983)⁶. In what follows, however, I shall restrict our discussion to compounds whose last component word is more than two morae long for the following two reasons: (a) they are highly regular with respect to accentual behavior, and (b) they predominate in complex compounds, compounds whose accentual behavior we are going to consider in this paper.

As (2) and (3) show, the Japanese CAR is essentially a mirror-image of the English compound stress rule: the lexical accent (if any) of the first element is deleted and that of the second noun survives as a compound accent. Interesting is the behavior of unaccented words: when the second noun happens to be lexically unaccented, which is quite usual, a new accent — compound accent — is added to its first mora so that the whole compound shows basically the same accentual pattern as others (cf. (3a) vs (3b)).

2. COMPLEX COMPOUND NOUNS: SYNTACTIC STRUCTURE⁷ AND ACCENTUAL PHRASING

In contrast to the great interest in the accent rules of two-noun compounds, little work has been done on the accent of more complex compounds. In fact, the only work I know on this subject is Hayata (1969), who attempted to analyze complex compound nouns in the framework of the SPE model of generative phonology.

Hayata is correct, despite some methodological and theoretical flaws⁸, in his implicit assumption that the accentual patterns of Japanese complex compound nouns are predictable by rule on the basis of their constituent structures. This basic assumption has been justified by my recent analysis of a few hundred complex compound nouns collected from Japanese newspapers and magazines, which has shown that complex compounds choose different accentual patterns depending on their branching structure⁹.

2.1 By way of introduction, let us consider some examples from three-noun compounds:

(4) Accentual Patterns of Three-Noun Compounds

(a) Left-branching constituent structure i.e.



i) *ABC (1 accentual unit)*

syakai hūkusi zigyoō → syakaihukusizigyoō
 syakaihukusizigyoō
 'society-welfare-serviced' = 'social welfare service'

kokuritu daigaku kyookai → kokuritudaigakukyookai
 kokuritudaigakukyookai
 'state-university-association' = 'Association of National Universities'

kaku zikken mondai → kakuzikkenmondai
 kakuzikkenmondai
 'nucleus-experiment-issue' = 'nuclear experiment issue'

(ii) *A-BC (2 accentual units)*

ziyuu minken undoo → ziyuu minkenundoo
 ziyuu minkenundoo
 'freedom-civil rights-movement' = 'movement for freedom and civil rights'

sattya reegan kaidan → sattya reegankaidan
 sattya reegankaidan
 'Thatcher-Reagan-talk' = 'Thatcher-Reagan Talk'

nakasone reegan kaidan → nakasone reegankaidan
 nakasone reegankaidan
 'Nakasone-Reagan-talk' = 'Nakasone-Reagan Talk'

koomu sikkoo boogai → koomu sikkooboogai
 koomu sikkooboogai
 'official duty-execution-interference' = 'interference with the execution of official duties'

minzoku ziketu syugi → minzoku ziketussyugi
 minzoku ziketussyugi
 'race-self determination-principle' = 'principle of racial self-determination'

(iii) *AB-C (2 accentual units)*

kokuritu daigaku kyoozyu → kokuritudaigaku kyoozyu
 'state-university-professor' = 'professor of a state university'

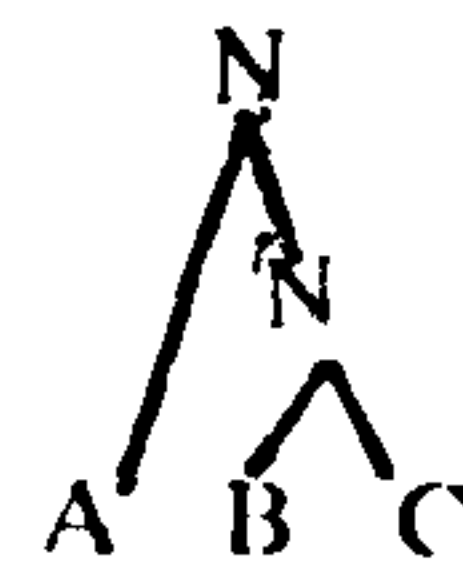
sukottorāndo tihōo nānbu → sukottorandotimoo nānbu
sukottoranditihoo nānbu
 ‘Scotland-region-south’ = ‘south of Scotland’

tookyoo daigaku igakubu → tookyoodaigaku igakubu
 'Tokyo-university-medical department' = 'Medical
 Department at Tokyo University'

mīnsyū kōkka kensetū → minsyūkōkka kensetū
minsyūkōkka kensetū
 'democracy-nation-construction' = 'construction of a
 democratic nation'

nihon rettoō kaizōō → nihonrettoō kaizōō
nihonrettoō kaizōō
 'Japan-islands-reconstruction' = 'reconstruction of the
 Japan Islands'

(b) Right-branching constituent structure i.e.



(i) ABC (1 accentual unit) --- optional

tyuuka zinmin kyoowakoku → tyuuka zihminkyooakoku
or tyuukazinminkyooakoku
'China-people-republic' = 'People's Republic of China'

tihōo kookyōō dantai[†] → tihōo kōokyoodantai
or tihōokōokyoodantai
'district-public-organization' = 'local public bodies'

(ii) A-BC (2 accentual units)

kokuritū geizyutū kyookaī → kokuritū geizyutukyookaī
 kokuritū geizyutukyookaī
 'state-art-association' = 'National Association of Art'

n̄libeī ānpō zyooyakū → n̄libeī anpozyōoyakū
 n̄libeī anpozyōoyakū
 'Japan/US-security-treaty' = 'Japan-US Security Treaty'

n̄libeī booēkī masatū̄ → n̄libeī booēkimāsatū
 n̄libeī booēkimāsatū
 'Japan/US-trade-friction' = 'trade friction between Japan and U.S.A.'

(iii) AB-C (2 accentual units)

(no example found)

(4) shows that three-noun compounds can take three types of accentual patterns: in (a-i) and (b-i), compounds are pronounced as a single accentual unit with its compound accent on the last component. In the other cases, on the other hand, compounds are decomposed into two accentual units, one with a lexical accent (if any) and the other with a compound accent. For example, ziyū minkenūdo 'movement for freedom and civil rights' consists of ziyū 'freedom' with its lexical accent on the second mora, and minkenūdo 'civil rights movement' with a compound accent on the first mora of its second component undo. This accentual phrasing takes place even if the first word is unaccented (e.g. nakasone reegankaidan 'Nakasone-Reagan Talk'), which suggests that accentual phrasing of compounds is independent both of the accentedness and accentuation of their component words.

A glance at the fragmentary examples in (4) might suggest no direct relation between the constituent structures of compounds and their accentual behavior. In statistical terms, however, there is a clear correspondence between the two structures, syntactic and accentual. Namely, most of the compounds with the left-branching constituent structure show the accentual pattern in (i), whereas right-branching compounds show the pattern in (ii) in most cases. In other words, (i) is the accentual pattern predominating left-branching compounds while the right-branching counterpart chooses (ii) as its unmarked accentual pattern.

2.2 A question may arise at this point over the syntactic category of the examples in (4b). That is, some might argue against my generalization based on branching structures, that what I treat here as right-branching

compound nouns are not compounds but noun phrases (NPs) consisting of an adjective and a compound noun:

(5)



e.g. $\overline{\text{nitibei}} \overline{\text{anpo}} \overline{\text{zyooyaku}}$ ‘Japan-US Security Treaty’

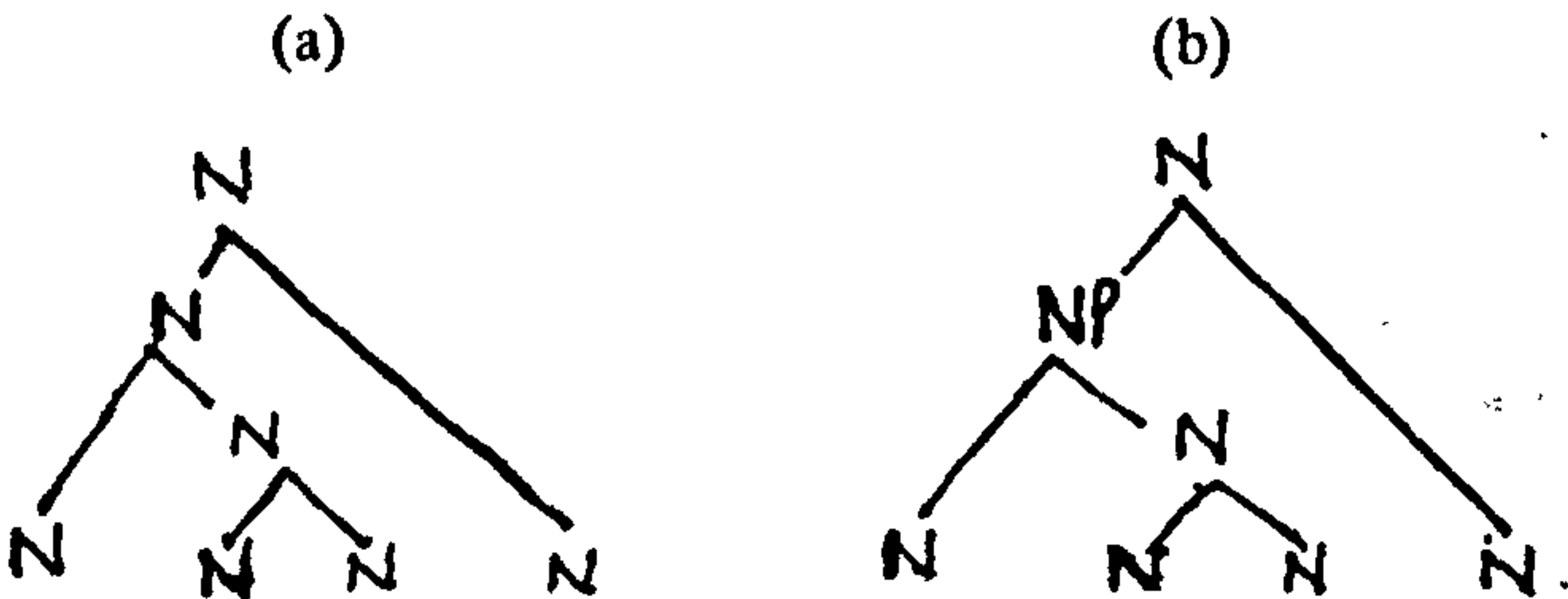
Although this interpretation may be appealing because of the adjectival function of the first component word (e.g. nitibei ‘Japan-US’ modifies anpo zyooyaku ‘security treaty’), there are several independent reasons to reject it in favor of my treatment. First, the first word in the ‘right-branching compounds’ is morphologically distinct both from adjectives proper and from the genitive forms of nominals (e.g. nitibeino). Second, ‘right-branching compounds’ in question can undergo the CAR when abbreviated, which suggests that the ‘right-branching compounds’ are semantically recognized as compound nouns, not as NPs:

(6) $\overline{\text{nitibei}} \overline{\text{anpo}} \xrightarrow{\text{CAR}} \overline{\text{nitibeianpo}}$

‘Japan/US-security’ = ‘Japan-US Security Treaty’

Third, the construction in question shows a syntactic behaviour as a noun in that it can be embedded in more complex compound noun structures:

(7) $\overline{\text{nitibei}} \overline{\text{anpo}} \overline{\text{zyooaku}} \overline{\text{mondai}}$
 ‘Japan/US-security-treaty-issue’ = ‘issue of the Japan-US Security Treaty’



Thus, the syntactic analysis in (5) results in a syntactically anomalous

structure as in (7b), where the node NP is directly governed by the node N.

In sum, all these facts seem to justify my treatment of the right-branching compounds as compound nouns, and hence the notion that two constituent structures, left-branching and right-branching, must be recognised for three-noun compounds. Given this theoretical basis, one may rightly ask how, then, we can formalize the observation that the two constituent structures prefer different accentual patterns. Before proceeding to this interesting question, however, let us go back to (4) and briefly consider the marked accentual patterns for each constituent structure.

2.3 Compounds showing the marked accentual patterns are not entirely idiosyncratic in nature but can be differentiated from those showing the unmarked patterns by certain semantic/pragmatic principles. For example, compounds belonging to the accentual pattern (4a-ii) fall into two types: either the first two nouns constitute a coordinate structure, or the second word is a verbal noun, i.e. a noun derived from a verb¹⁰. Not surprisingly, the first two nouns of the compounds do not undergo the CAR when they are pronounced separately from the last noun:

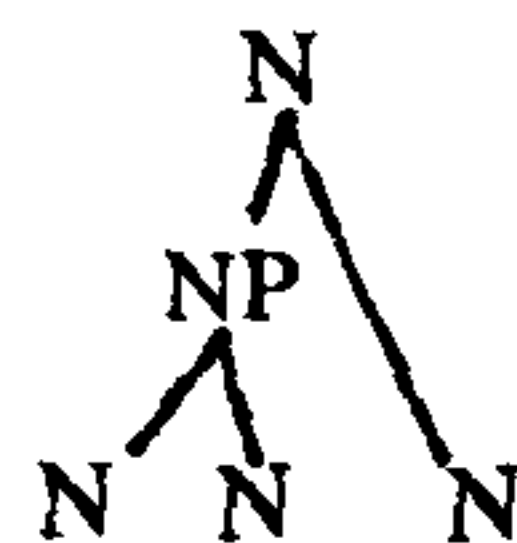
- (8) ziyuu minken → ziyu minken *ziyuuminken
 'freedom-civil rights'
- sattyya reegan → satyaa reegan *satyaareegan
 'Thatcher-Reagan'
- koomu sikkoo → koomu sikkoo *koomusikoo
 'public duties-execution'

One possible functional account of this phenomenon would be that verbal nouns are less likely to undergo the prosodic compounding rule because of their verbal semantic content, and that coordinate structures show the same tendency because of the equal weight between the two elements. Be that as it may, what deserves our attention as regards (4a-ii) is the fact that the prosodic compounding occurs between the last two elements despite the fact that the rule does not apply to its lower domain:

- e.g. minken̄ undoō → minkenundoō 'civil rights movement'
sikkoō boogaī → sikkooboogai 'execution-interference'.

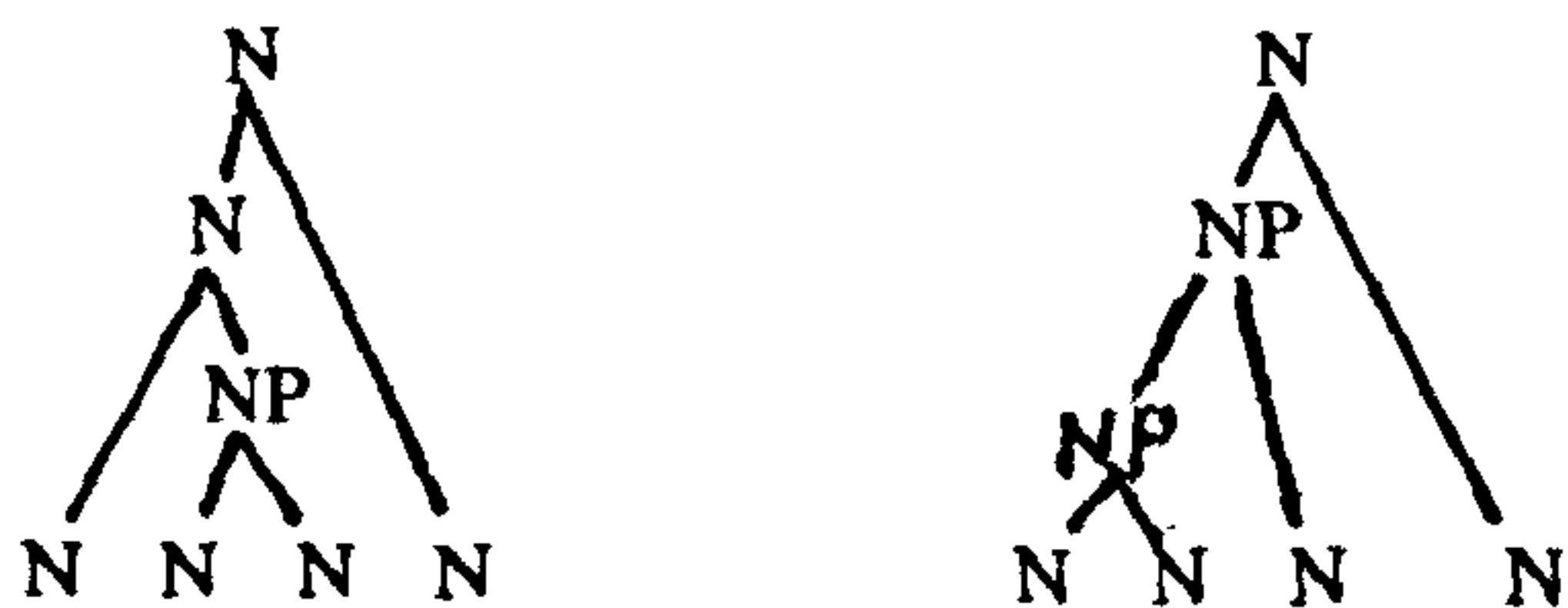
Hayata (ibid.) attempts to account for this by assuming the following syntactic structure for the compounds in question where, he argues, the **CAR** is blocked by the syntactic node NP in the lower domain but not in the higher domain, which is dominated by N:

(9)



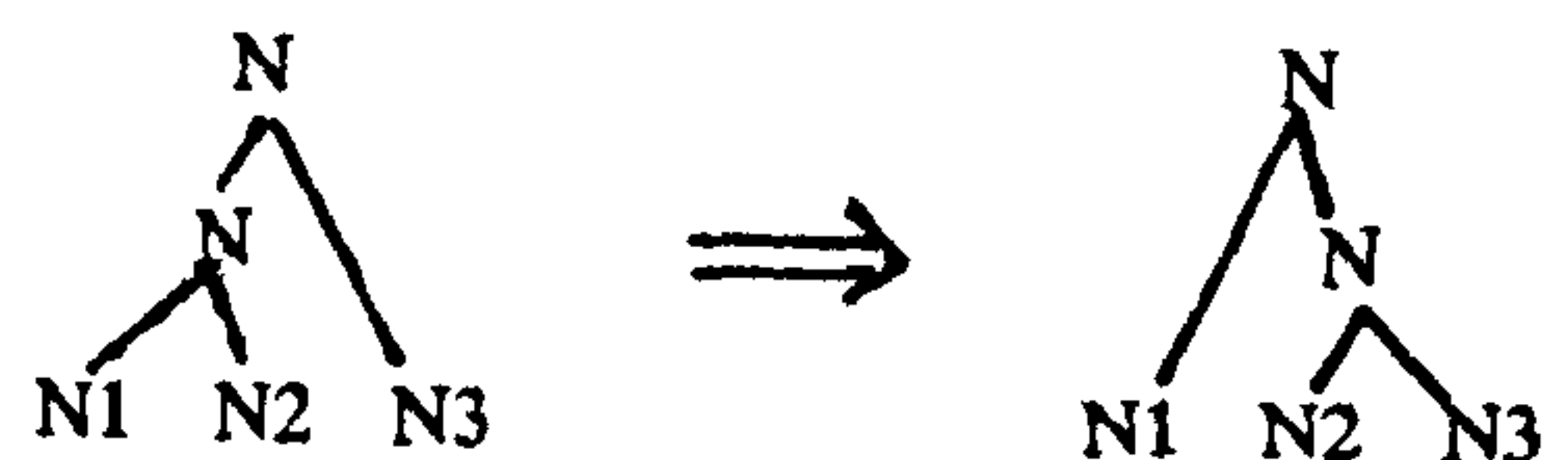
This analysis suffers from the following criticisms. First, it involves a syntactically anomalous structure where NP is directly governed by N. Second, it does not reasonably account for the fact that the CAR applies between the second and third elements where the node NP intervenes. Third, it is not capable of correctly predicting the accentual patterns of more complex compounds involving such 'NPs': e.g.

(10)



An alternative and more plausible account would be to assume a restructuring of the constituent structure as follows:

(11) Restructuring



Condition: if [N1 N2] does not undergo CAR

This alternative solution succeeds not only in avoiding the difficulties inherent in Hayata's analysis but also in accounting for the fact that the compounds in question show the same accentual pattern as the unmarked right-branching compounds (i.e. (4b-ii)).

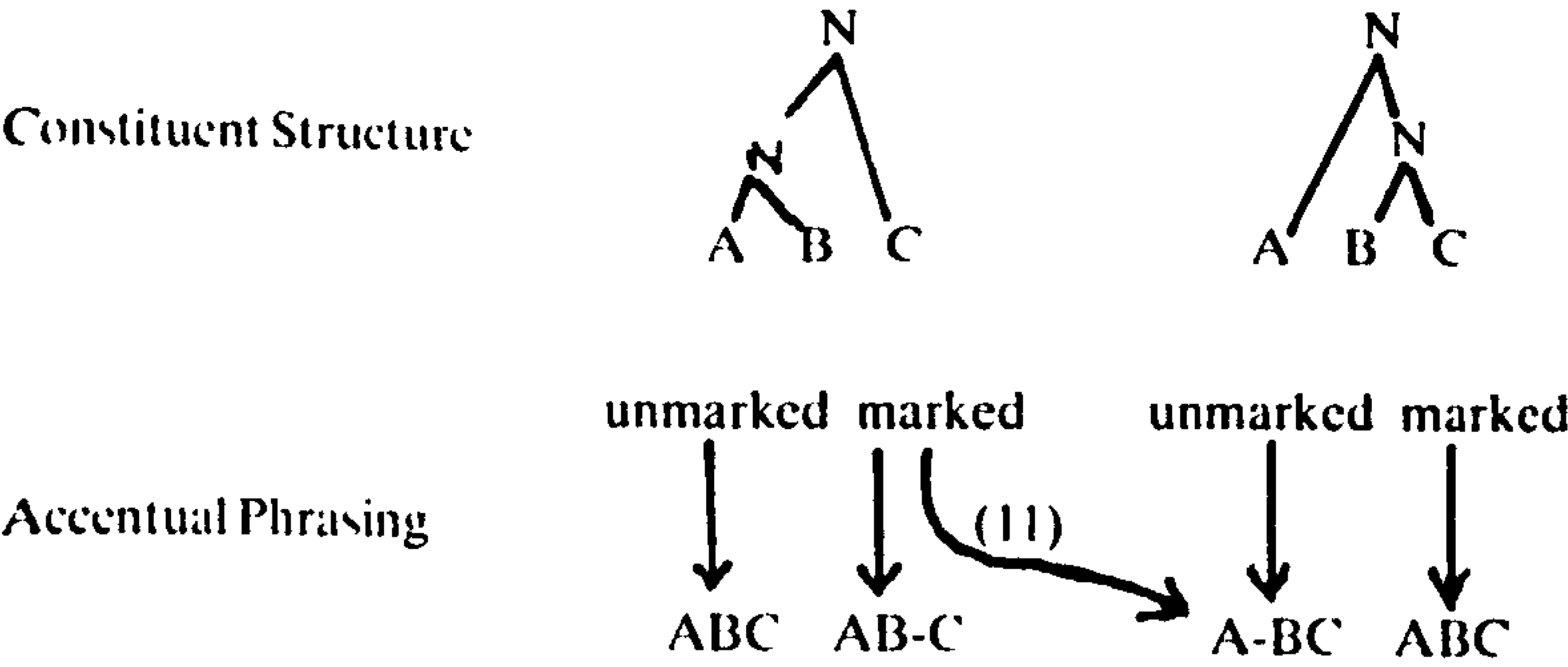
Let us move on to the other marked accentual patterns in (4). (4a-iii)

seems to cover at least three types of compounds. In one type, the compound of the first two words represents an organization while the last noun represents a status in it. In another, the sequence of the first two nouns represents a spatial area or an organization and the last noun specifies it further. And in the last type, the third component word is a verbal noun.



The marked accentual pattern for the right-branching compounds, i.e. (4b-i), is a variant pattern of the unmarked case (4b-ii). Namely, it was observed that right-branching compounds tend to be produced as a single accentual unit when uttered in fast speech and/or when they are totally familiar to the speaker. This tendency is shared by the left-branching compounds decomposed into two accentual units, i.e. (4a-ii), which reinforces my view that those compounds undergo restructuring as in (11).

2.4 In summary, three-noun compounds in Japanese undergo the following accentual phrasing process:

(12) Three-Noun Compounds: Summary

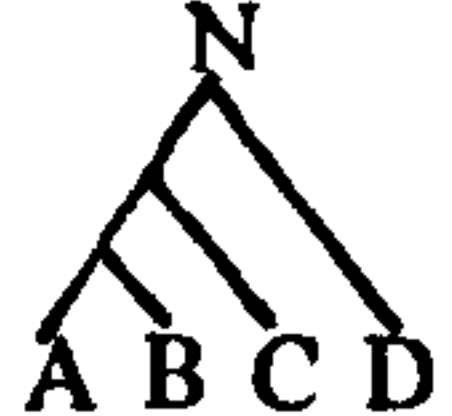






It may deserve adding here that the syntactic constraint in (13) allows us to account for an accentual phenomenon which Hayata (ibid.) observed but failed to explain. He reports (p.67) that there is an accentual difference between two similar borrowed words, bōsuton reddosōkkusu ‘Boston Red Sox’ and nyuuyooku yānkiizu ‘New York Yankees’: the former is decomposed into two accentual units while the latter is phrased into one. This accentual difference can be straightforwardly accounted for by our constraint in (13) if we consider the difference in constituent structure:¹¹

	(14)		
		bosuton reddosokkusu	nyuuyooku yankiizu
		‘Boston Red Sox’	‘New York Yankees’
Constituent Structure			
Lexical Representation		bōsuton reddo sōkkusu	nyūu yōoku yānkiizu
		// CAR (2) & (13) //	
Accent Pattern		bōsuton reddosōkkusu	nyuuyookuyānkiizu
		//PITCH/TONE ASSIGNMENT RULES//	
Output		bosuton reddosokkusu	nyuuyookuyānkiizu

3. PROSODY OF FOUR-NOUN COMPOUNDS

3.1 Let us next consider more complex compound structures to see if our rules correctly predict their accentual phrasing patterns. (15) represents the five constituent structures four-word compound nouns can possibly take, and their unmarked accentual patterns predicted by the constraint (13):

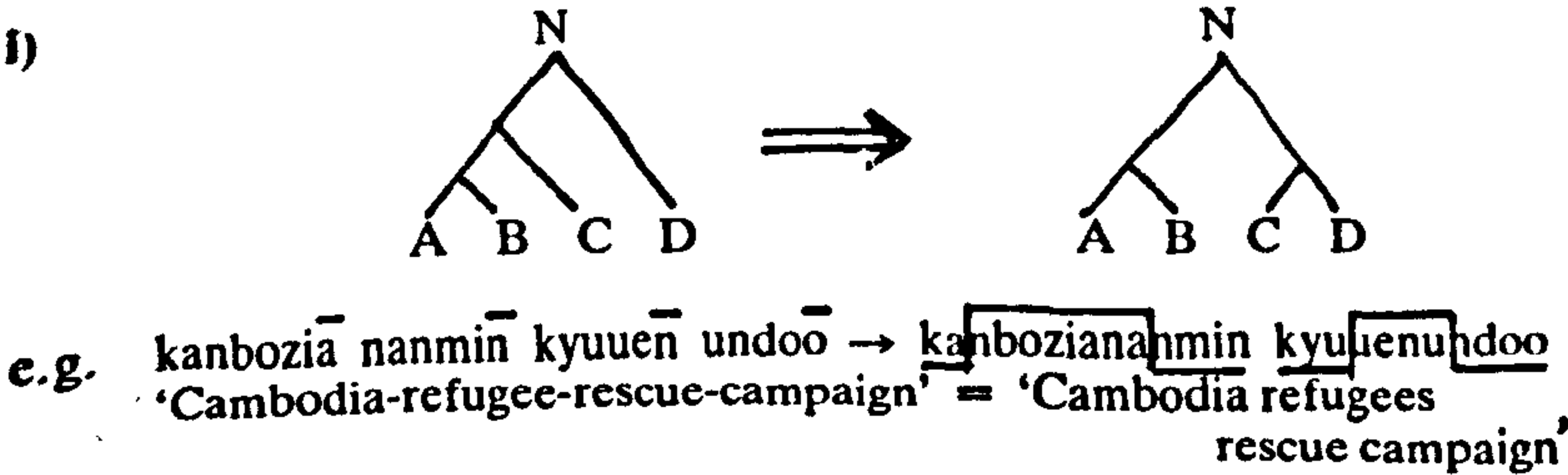
	(15)					
		a)	b)	c)	d)	e)
Constituent Structure						
Unmarked Phrasing Pattern		ABCD	A-BCD	A-BCD	AB-CD	A-B-CD

As far as the about one hundred examples I have analyzed are concerned, the left-branching constituent structure, (15a), is no doubt the most common type of all, although other compound structures are also found. More importantly, the analysis has shown that most of the four-word compound nouns exhibit accentual patterns as depicted in (15), some examples of which are shown below:

- (16) (a) $\text{syakai hukusi seisaku mondai} \rightarrow \text{syakai hukusi seisaku mondai}$
 'society-welfare-policy-issue' = 'issue of social welfare policies'
- $\text{iryoo seido kaikaku hooan} \rightarrow \text{iryoo seido kaikaku hooan}$
 'medical-system-reform-bill' = 'medical system reform bill'
- (b) $\text{supootu soogo zyoo ho bangumi} \rightarrow \text{supootu soogo zyoo ho bangumi}$
 'sport-synthesis-information-program' = '(TV/radio) program on all-round sport information'
- (c) $\text{nitibei anzen hoso zyoyaku} \rightarrow \text{nitibei anzen hoso zyoyaku}$
 'Japan/US-security-guarantee-treaty' = 'Japan-US Security Treaty'
- (d) $\text{keizai taisaku kakuryoo kaigi} \rightarrow \text{keizai taisaku kakuryoo kaigi}$
 'economy-measures-cabinet-meeting' = 'Cabinet meeting on economic measures'
- (e) $\text{kindai nihon zyozyoo bungaku} \rightarrow \text{kindai nihon zyozyoo bungaku}$
 'modern times-Japan-lyricism-literature' = 'modern Japanese lyric literature'

In fact, the data analyzed can be accounted for almost exhaustively by our constraint if we additionally assume the restructuring we saw before for three-noun compounds, i.e. (11):

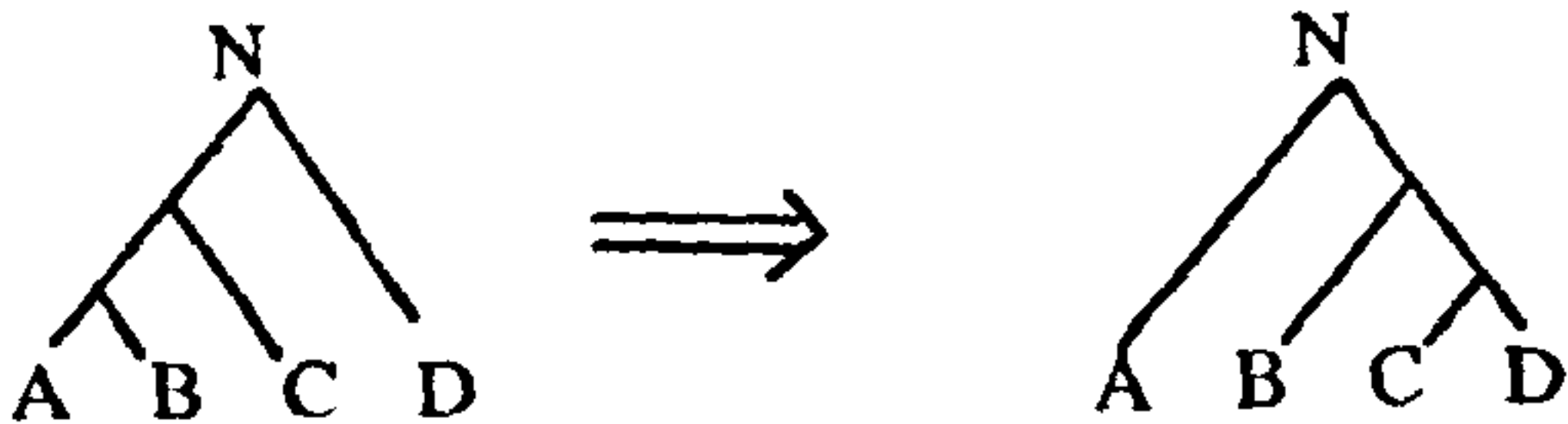
(17) Restructuring in Four-Noun Compounds



$\overline{\text{kokunai}} \overline{\text{sizyoo}} \overline{\text{kaihoo}} \overline{\text{mondai}} \rightarrow \overline{\text{kokunaisizyoo}} \overline{\text{kaihoomondai}}$
 'home-market-opening-issue' = 'issue of the opening of domestic market'

(the third words kyuuen and kaihoo are verbal nouns)

ii)



e.g. $\overline{\text{zenkoku}} \overline{\text{zendo}} \overline{\text{kooenka}} \overline{\text{koosoo}} \rightarrow \overline{\text{zenkoku}} \overline{\text{zendo}} \overline{\text{kooenkakosoo}}$
 'whole country-whole land-parking-plan' = 'plan to make the whole country a park'

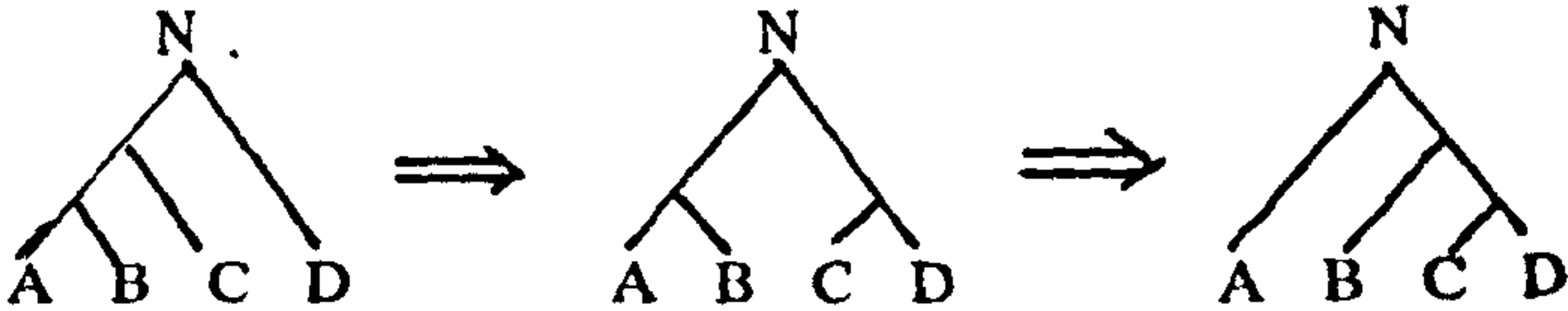
(A and B constitute a coordinate structure, C being a verbal noun)

$\overline{\text{beecka}} \overline{\text{neage}} \overline{\text{hantai}} \overline{\text{undoo}} \rightarrow \overline{\text{beecka}} \overline{\text{neage}} \overline{\text{hantaiundoo}}$
 'rice price-raising-protest-campaign' = 'campaign protesting against the rise of rice price'

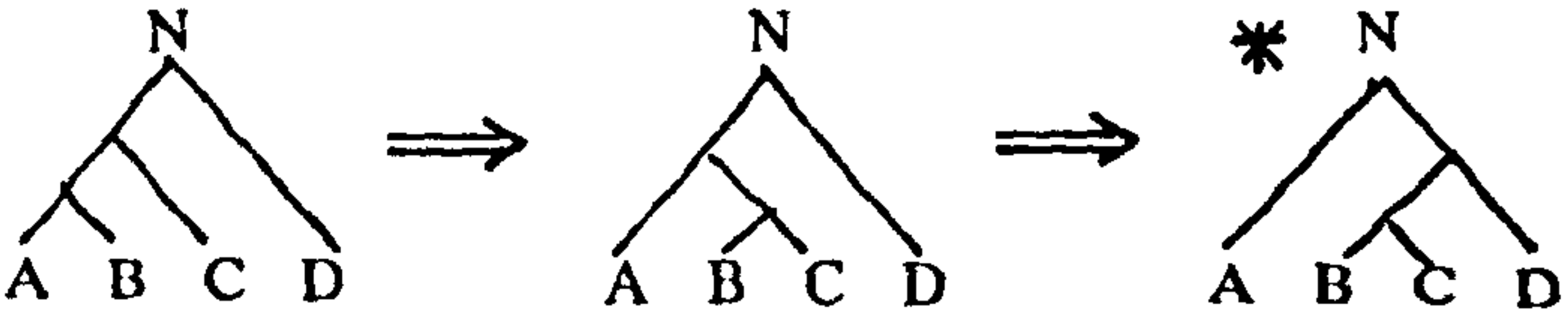
(B and C are verbal nouns)

The examples in (17-ii), which have undergone the restructuring twice, suggest that the restructuring takes place in a right-to-left order, not in a left-to-right or cyclic order:

(18) (a) right-to-left operation



(b) left-to-right or cyclic operation



3.2 Besides this, the following words should be added as to the accentual behavior of four-noun compounds. First, it was observed that four-noun compounds share with the three-noun compounds the tendency towards optional accentual unification as they are uttered in faster speech and/or as they become more familiar to the speaker:

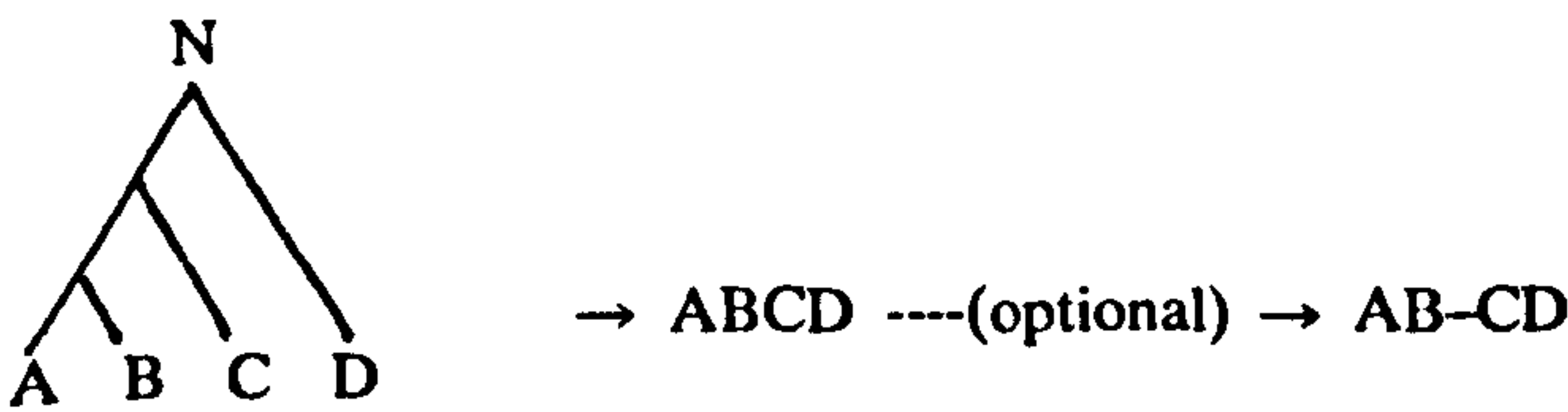
(19) Optional Accentual Unification Caused by Pragmatic Factors

e.g. z̄isyu k̄anri roodoō kumiaī → z̄isyukanri roodokumiaī
 or z̄isyukanriroodokumiaī
 ‘autonomy-management-labor-union’ = ‘labor union with autonomous management’ = ‘Solidarity Union’

supōbtu soogoō zyoohoō bangumī̄ → supōbtu soogoozyoohoobangumī
 or supōbtusoogoozyoohoobangumī
 ‘program on all-round sport information’

Second, four-noun compounds can be optionally split into two accentual units in cases where our rule predicts that they are pronounced as a single unit:

(20) Optional Accentual Split



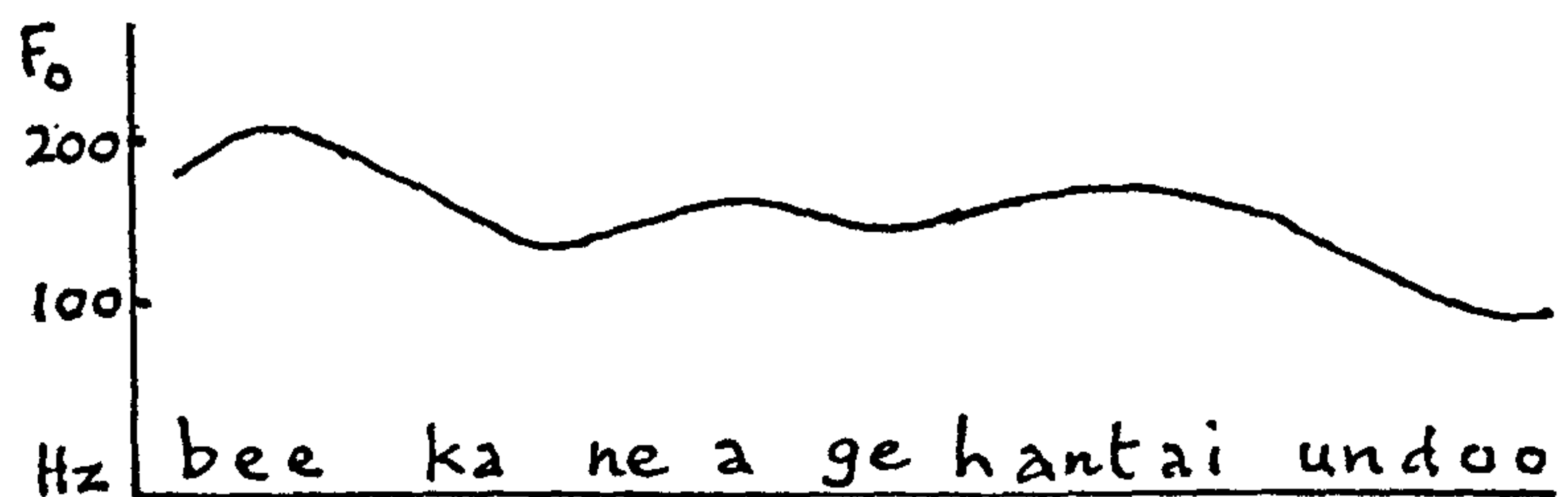
e.g. sȳakai huk̄usi seisakū mondaī → sȳakaihukusiseisakumondaī
 or sȳakaihukusi seisakumondaī
 ‘issue of social welfare policies’

iryoo seido kaikaku hooan → iryooseidokaikakuhooan
 or iryooseido kaikakuhooan
 ‘medical system reform bill’

In the absence of sufficient data, it is difficult to say whether this is a general prosodic rule, or, if it is, why it should happen in the first place. It may be because of some rhythmic effect or it may be due to some cognitive constraint on excessively long prosodic units.¹² Finally, let us consider the prominence pattern of four-noun compounds which are decomposed into three accentual units. Hayata (ibid:56) reports

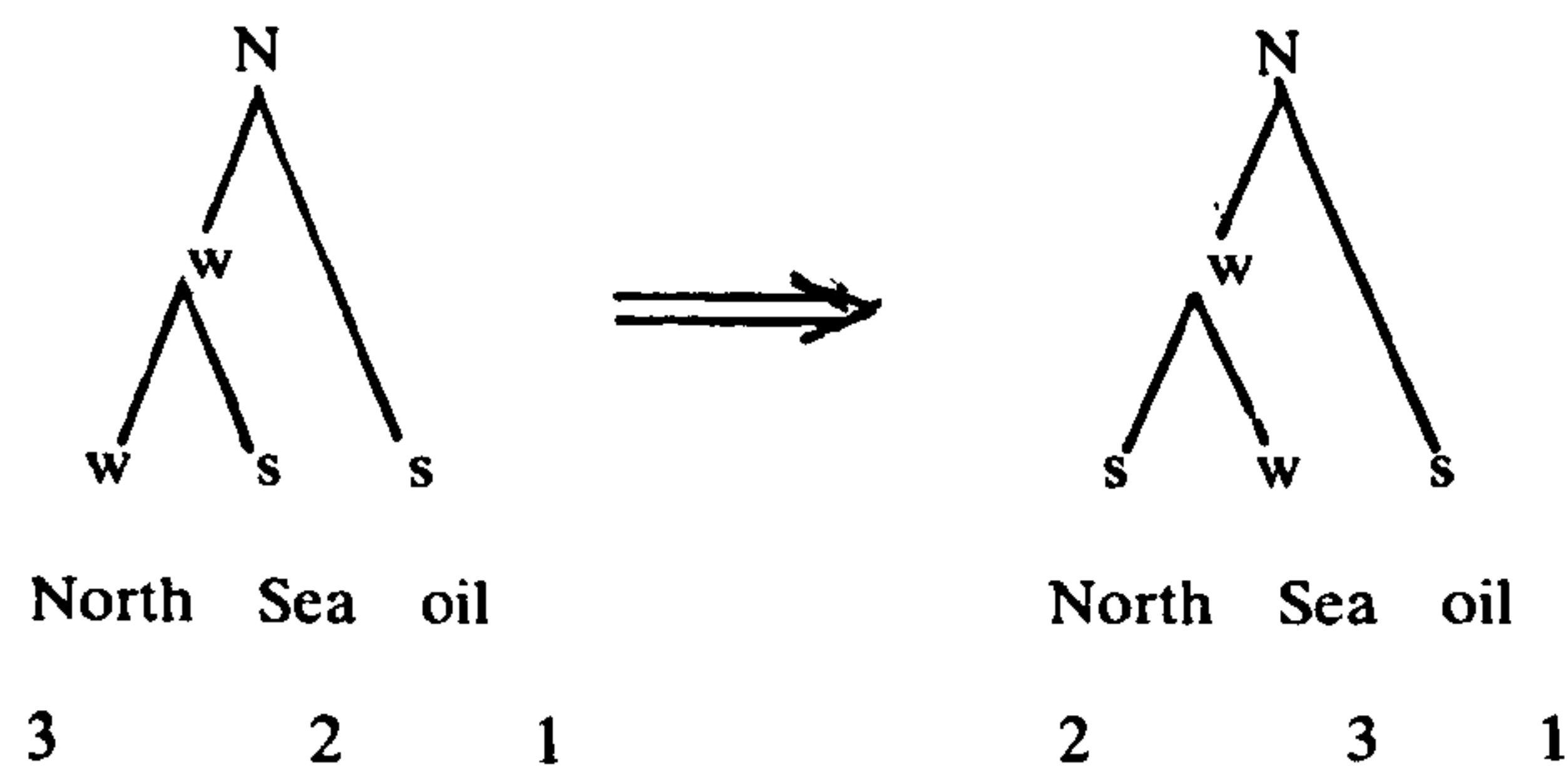
that beeka nea[~]ge hantai[~]undoo 'movement against the rise in rice price' exhibits the following Fo contour, which he analyzes as having a prominence pattern 1-3-2:

(21)



Similarly, my preliminary observation of the Fo contour of the right-branching compound in (17e) has shown a similar Fo pattern where the Fo peak of the third accentual unit is realized slightly higher than that of the preceding one. These observations have a significant implication for intonational phonology of Japanese because of the inability of existing prosodic theories of Japanese to account for the observed prominence pattern satisfactorily. To be more specific, the prominence pattern observed cannot be adequately handled either by the *tone-sequence* model of intonation¹³ where Fo contours are represented as sequences of tone associated with accents and boundaries (cf. McCawley 1968; Haraguchi 1977; Poser 1984), or by the *contour interaction* model¹³ which assumes that local accentual configurations are overlaid on a global slope (cf. Fujisaki & Sudo 1971). One account these previous models can possibly provide for the prominence pattern in question is that the second and the third Fo peaks are divided by an intonational boundary (or McCawley's *major phrase boundary*). This account is not intuitively preferred given the idea that major intonational boundaries generally coincide with major syntactic boundaries (cf. McCawley *ibid*:177; Fujisaki & Sudo *ibid*:76; Poser *ibid*:146ff). The only solution one can find, then, without invoking the notion of intonational boundary would be to assume independent, additional machinery by which the surface prominence pattern 1-3-2 is derived from 1-2-3. Interestingly, this is a process which is very similar, both formally and functionally, to what is generally called *Stress Shift* or *Rhythm Rule* in English (cf. Fudge 1984:137):

(22) Rhythm Rule in English Compound Nouns



This line of research might give an extremely interesting insight into the abstract rhythmic structure of Japanese, which I shall discuss in another paper.

4. RELATED PHENOMENON: ACCENT PHRASE FORMATION

From the discussion in the preceding sections, it is clear that the Japanese CAR is blocked by right-branching constituent structure. In the following two sections, I will show that the same syntactic constraint applies to two other prosodic processes of Japanese, both from the phrasal prosody of the language. One of them is a process called *Accent Phrase Formation (APF)* (cf. Fujisaki & Sudo *ibid.*) whereby two accentual units are unified into one if the first element is unaccented:¹⁴

(23) APF

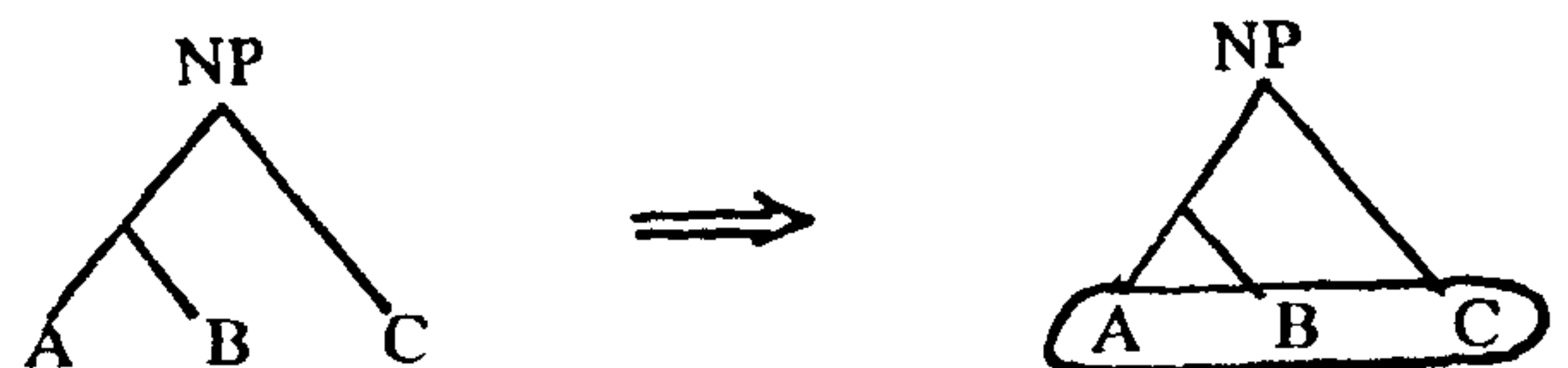
anō usi → a^hno usi 'that cow'

akai asiato → a^hkai asiato 'red footprint'

What happens to a sequence of three accentual units is exactly the same as we saw with three-noun compounds: if the phrase is left-branching, APF applies to it entirely to produce a single accentual unit, whereas its application is blocked if the phrase is right-branching (cf. Fujisaki & Sudo *ibid.*:79):

(24) APF

(a) left-branching structure



e.g. $\text{an}\bar{o} \text{ usin}\bar{o} \text{ koy}\bar{a} \rightarrow \text{a}\bar{h}\bar{o} \text{ usino koy}\bar{a}$
 'that-cow's-hut' = 'hut of that cow'

$\text{ak}\bar{a}\bar{i} \text{ usin}\bar{o} \text{ asi}\bar{a}\bar{t}\bar{o} \rightarrow \text{a}\bar{k}\bar{a}\bar{i} \text{ usino asi}\bar{a}\bar{t}\bar{o}$
 'red-cow's-footprint' = 'footprint by red cow'

(b) right-branching structure



e.g. $\text{an}\bar{o} \text{ usin}\bar{o} \text{ koy}\bar{a} \rightarrow \text{a}\bar{h}\bar{o} \text{ usino koy}\bar{a}$
 'that-cow's-hut' = 'that cowshed'

$\text{ak}\bar{a}\bar{i} \text{ usin}\bar{o} \text{ asi}\bar{a}\bar{t}\bar{o} \rightarrow \text{a}\bar{k}\bar{a}\bar{i} \text{ usino asi}\bar{a}\bar{t}\bar{o}$
 'red-cow's-footprint' = 'red footprint by a cow'

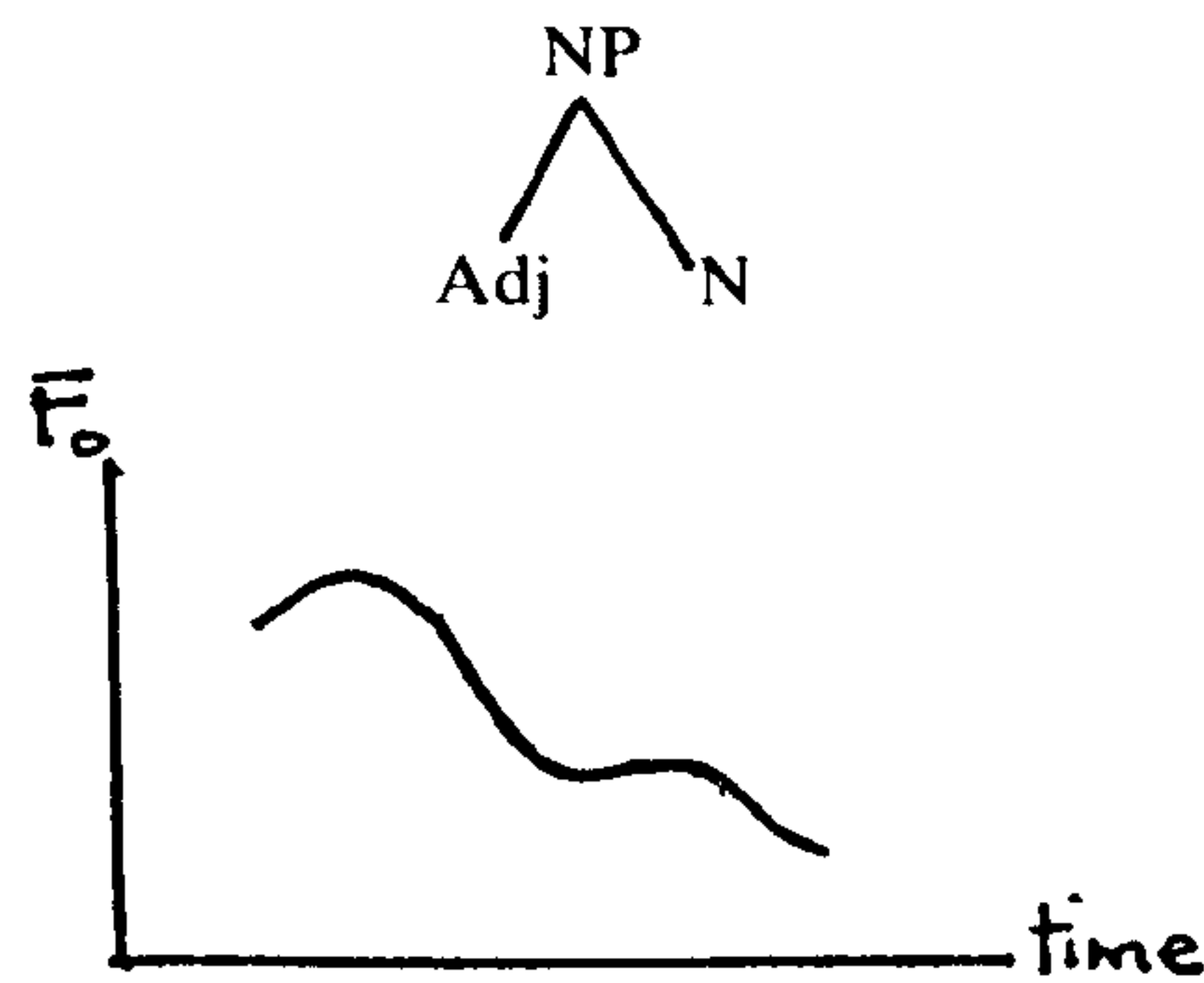
To be precise, APF as described in (24) is not an obligatory rule in the strict sense of the term: the rule can fail to apply to the left-branching structure in deliberately slow speech, in contrastive contexts, etc. Meanwhile, the right-branching structure can be pronounced as a single accentual unit in fast speech and, moreover, pause can take the place of the phrase-medial pitch drop (cf. Ueno et al. 1981) although it may slightly deteriorate the naturalness of speech. With all these provisos, however, the fact remains that APF can apply to any sequence of two accentual units in non-contrastive, normal-tempo speech if (a) the first element is unaccented, and (b) the second element does not branch.

5. RELATED PHENOMENON: DOWNDRIFT

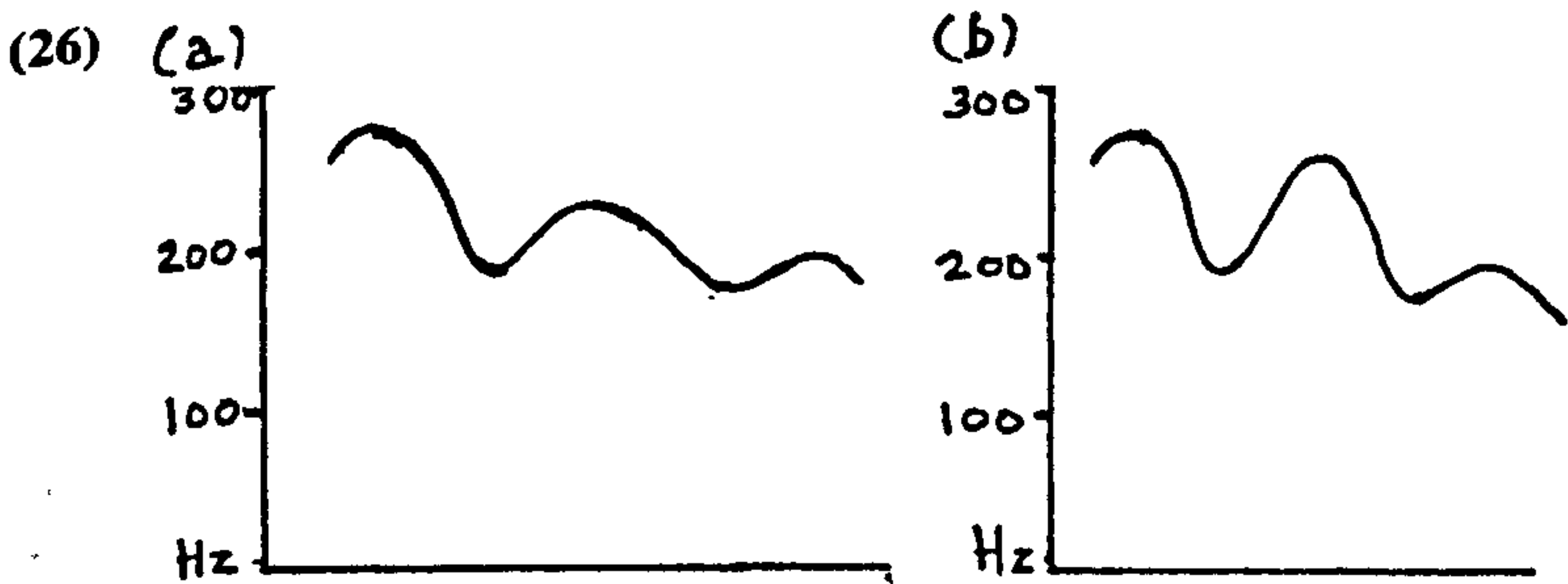
A similar situation is to be found with another aspect of phrasal prosody of Japanese, this time in a sequence of accented words. When two or more accents compete with each other within a phrase, the nuclear accent rule of

the language predicts that the leftmost accent dominates the phrase and others are radically reduced (cf. McCawley 1968:172ff; Haraguchi 1977:31ff; Poser 1984; Chapter 5) — this is a mirror-image of the English nuclear stress rule. Thus, a noun phrase consisting of an accented adjective and an accented noun shows a Fo contour like (25):

(25) Downdrift



This process is called variously by different researchers: *accent reduction* by McCawley (ibid); *downdrift* by Haraguchi (ibid); *catathesis* by Poser (ibid.). Just like the two prosodic processes we have seen so far, this process is dependent on the syntactic structure of the whole phrase and does not apply over any right-branching syntactic node:¹⁵



- (a)

(b)

Taroono itokono okusan 'Taro's cousin's wife'

Taroono wakareta okusan 'Taro's divorced wife'

In (26a), the Fo peak of the second word is considerably lower than that of the first word, while that of the third word is realized lower still. In (26b), by contrast, the Fo peak of the second word is not strikingly lower than its preceding peak but the third peak is evidently much lower than the other

two. The difference in Fo value between the two second peaks in (26) is statistically significant: $P(T=4.72, df=18) < .001$. Thus, the two types of noun phrases show, despite the same accentual pattern, different pitch patterns depending on their syntactic structure: the left-branching NP undergoes the process of downdrift as a whole, while its right-branching counterpart shows a clear effect of the process only within its innermost NP.

It should be noted, in this regard, that Poser (ibid) reports that downdrift (his *catathesis*) applies to the whole domain of right-branching NPs. Apart from the fact that he analyzes only right-branching structures in his work, it should be pointed out that his experimental result cannot be totally reproduced. (27) shows the result obtained from my experiment where the same NPs as Poser used in his experiment were analyzed:

(27) (a) $um\bar{a}i$ $namanur\bar{u}i$ $nomi\bar{m}ono$ 'tasty, lukewarm drink'

averaged Fo values of peaks (in Hz)

first peak	second peak	third peak
252.7 (SD=14.1)	249.7 (SD=12.8)	190.3 (SD=4.2)

(b) $am\bar{a}i$ $namanur\bar{u}i$ $nomi\bar{m}ono$ 'sweet, lukewarm drink'

first peak	second peak	third peak
240.5 (SD=17.1)	235.5 (SD=9.7)	177.1 (SD=5.8)

In (27a), we find that the Fo peak of the second word is not greatly lower than that of the first one, the difference being not statistically significant: $P(T=0.499, df=18) > .20$. Moreover, a comparison of (27a) and (27b) weakens Poser's contention that "the rate of Fo downdrift is significantly greater following accented words than following unaccented words (p.289)."

In any case, it could be argued that the right-branching syntactic node in right-branching NPs prevents the process of downdrift or, at least, it weakens the effect of the prosodic process.

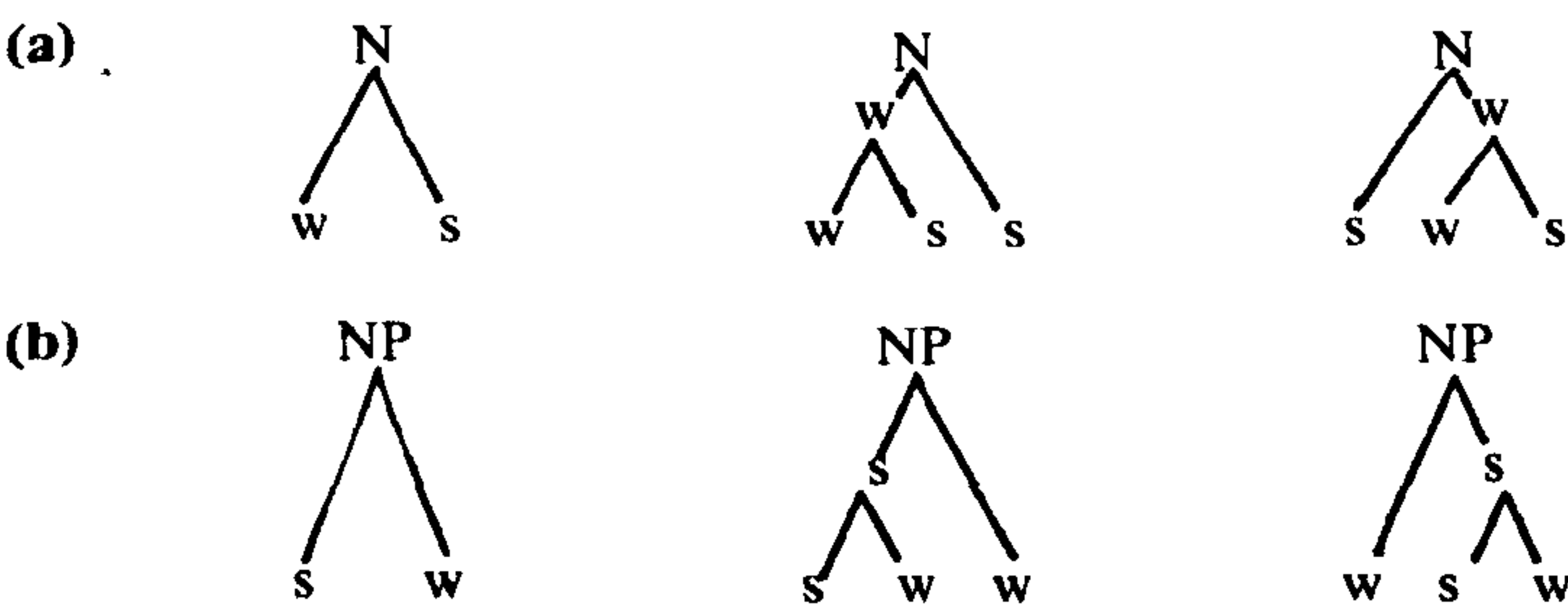
CONCLUSION AND THEORETICAL IMPLICATIONS

From the discussion so far, it will be understood that the same syntactic constraint is at work on several apparently independent prosodic processes in Japanese — the compound accent rule, the accent phrase formation rule and the process of downdrift.

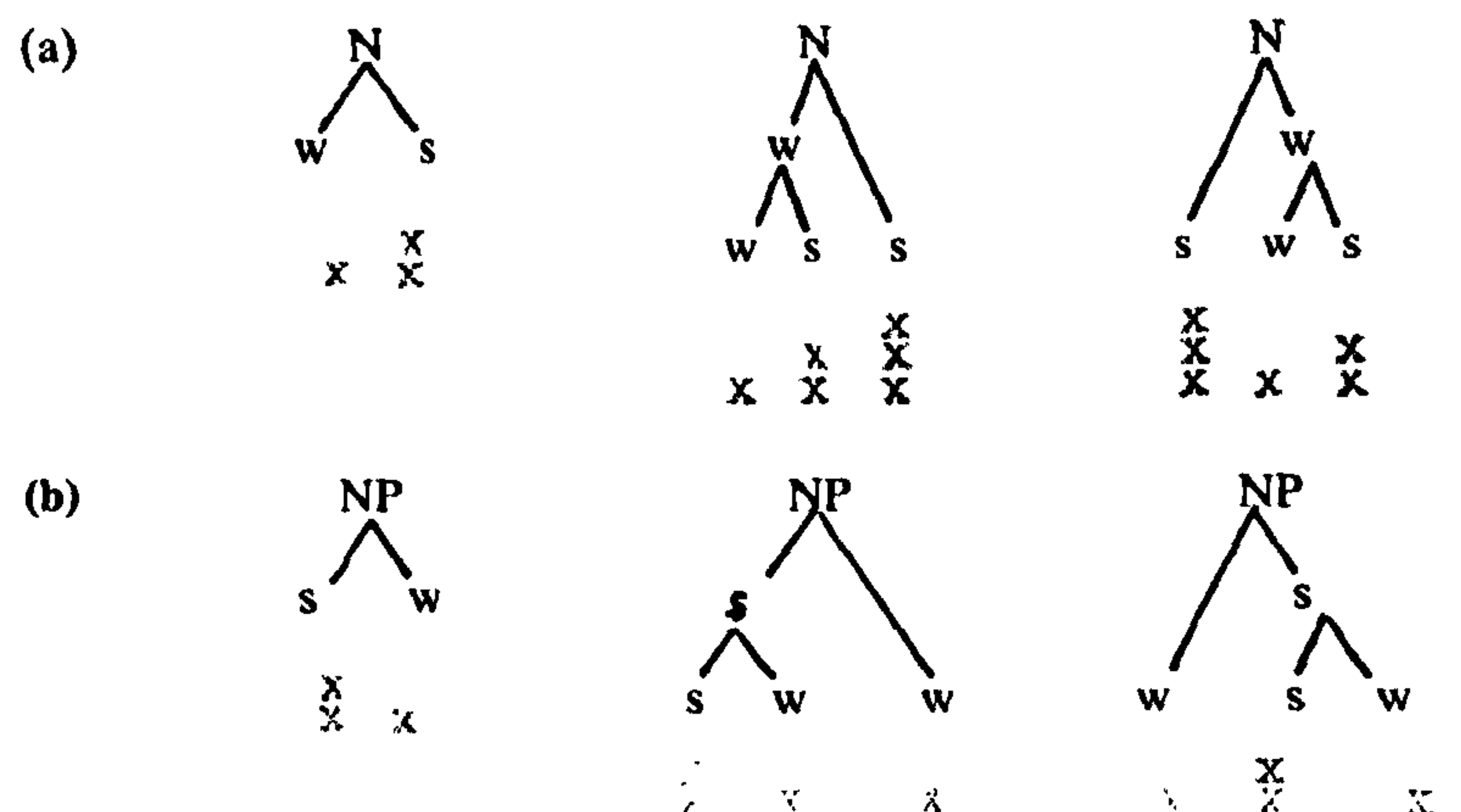
There seem to be two ways of incorporating this observation into the theoretical framework of Japanese phonology. One of them is to regard the syntactic constraint as a global constraint on prosodic processes, i.e. as a constraint that applies at any prosodic level, both lexical and post-lexical. An alternative treatment, which I am inclined to adopt, is to reinterpret the syntactic constraint in the framework of Metrical Theory in such a way that

the global nature of the constraint is seen to derive from the prominence (or dependency) relations inherent in the syntactic structures of the language (cf. Liberman & Prince 1977; Selkirk 1984). On this view, the two syntactic structures, left-branching and right-branching, could be analyzed as having the following metrical tree structures:

(28) Metrical Tree Structures of Japanese Compound nouns and NPs



(31) Metrical Grid Representation of Japanese Compound Nouns and NPs



Despite the tentative nature of these representations, this line of metrical approach has far-reaching implications for the prosodic phonology of Japanese. It implies, in the first place, that metrical structures be treated independently both from syntactic and accentual structures. It means, in other words, that the metrical level should be regarded as an autonomous autosegmental tier, independent of other tiers such as segmental and accentual. Surface 'pitch pattern' of a compound lexical item, phrase or sentence, therefore, is not exclusively determined by its accentual structure but reflects both the accentual structure and the metrical structure aligned with it.

On this view, the prosodic phenomena discussed in the previous sections could be restated and reformulated as in the following:

1. The CAR is sensitive to the metrical structure of the compound noun, not to its syntactic structure. (13) should, therefore, be reformulated as (32):

(32) [_c A B _c] undergoes CAR

Conditions: (a) if C is a compound noun
(b) if B is metrically stronger than A

2. Similarly, APF and downdrift are to be viewed as being sensitive to the metrical structure of a phrase, applying to a phrasal constituent [_c A B _c] where B is NOT metrically stronger than A:

(33) [_c A B _c] undergoes APF

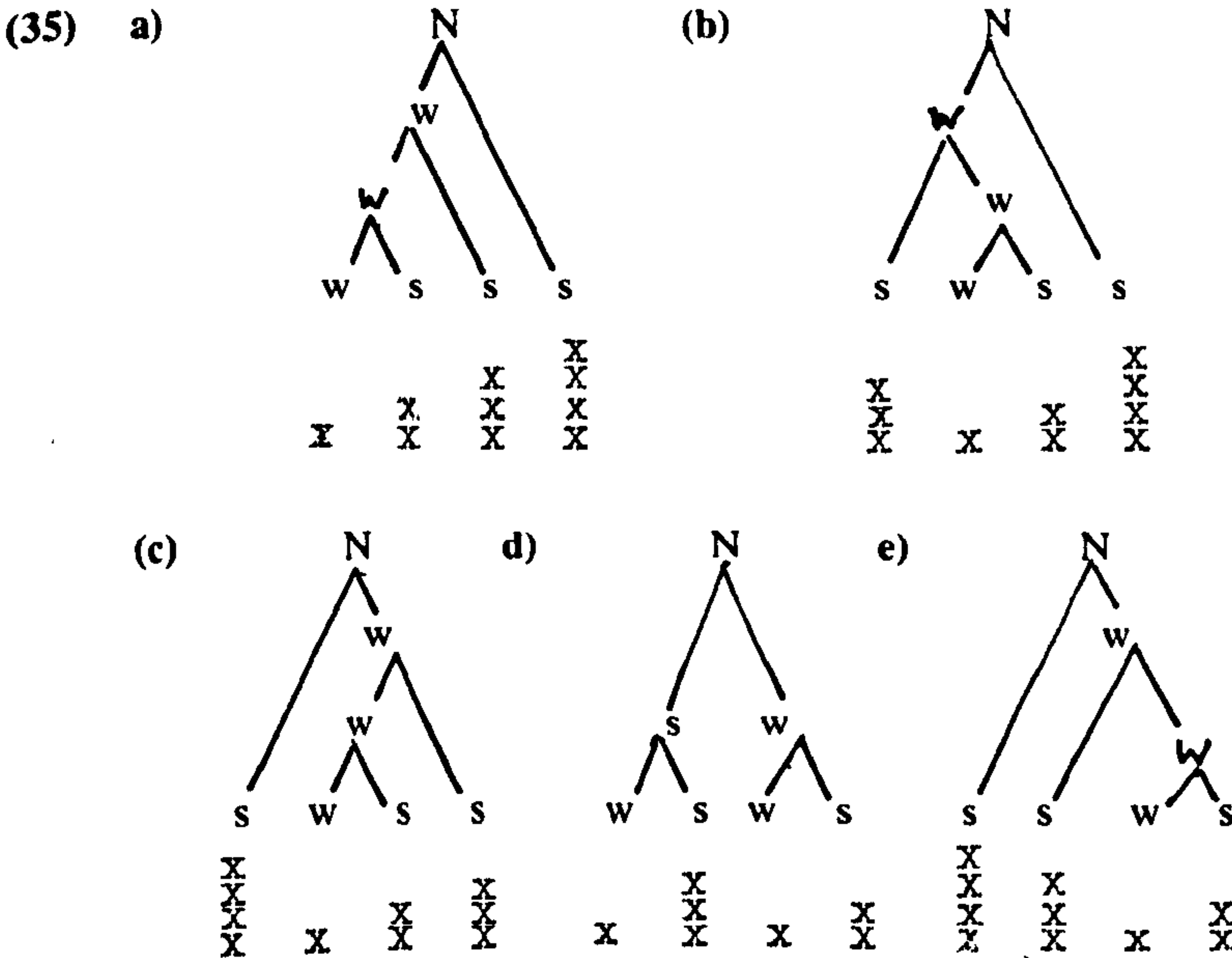
- Conditions: (a) if C is a phrasal category
(b) if A is unaccented
(c) if B is not metrically stronger than A

(34) [_c A B _c] undergoes downdrift

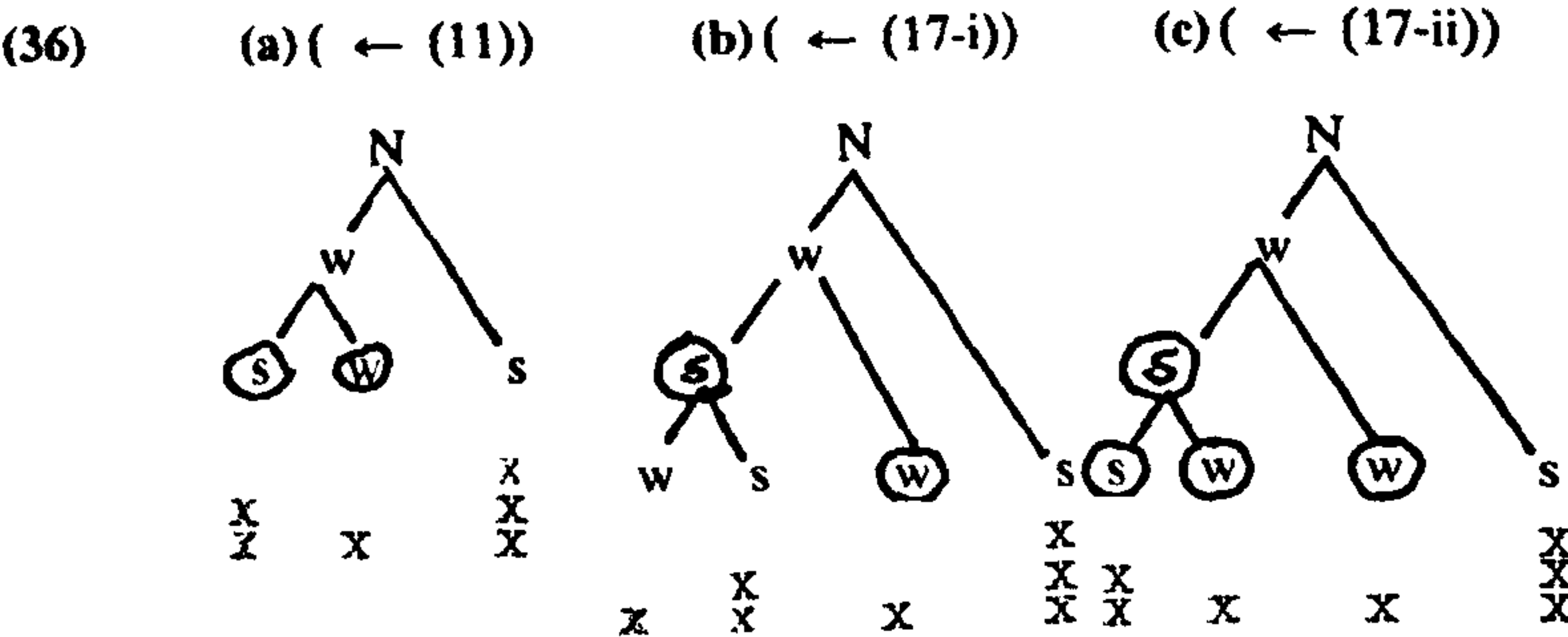
- Conditions: (a) if C is a phrasal category
(b) if A is accented
(c) if B is not metrically stronger than A

As is seen from the conditions in (33) and (34), APF and downdrift are in a complementary relation. Moreover, these two processes do not ‘compete’ with the process of prosodic compounding because of the different prosodic levels at which they apply: the former rules apply at the post-lexical level while the latter applies at the lexical level.

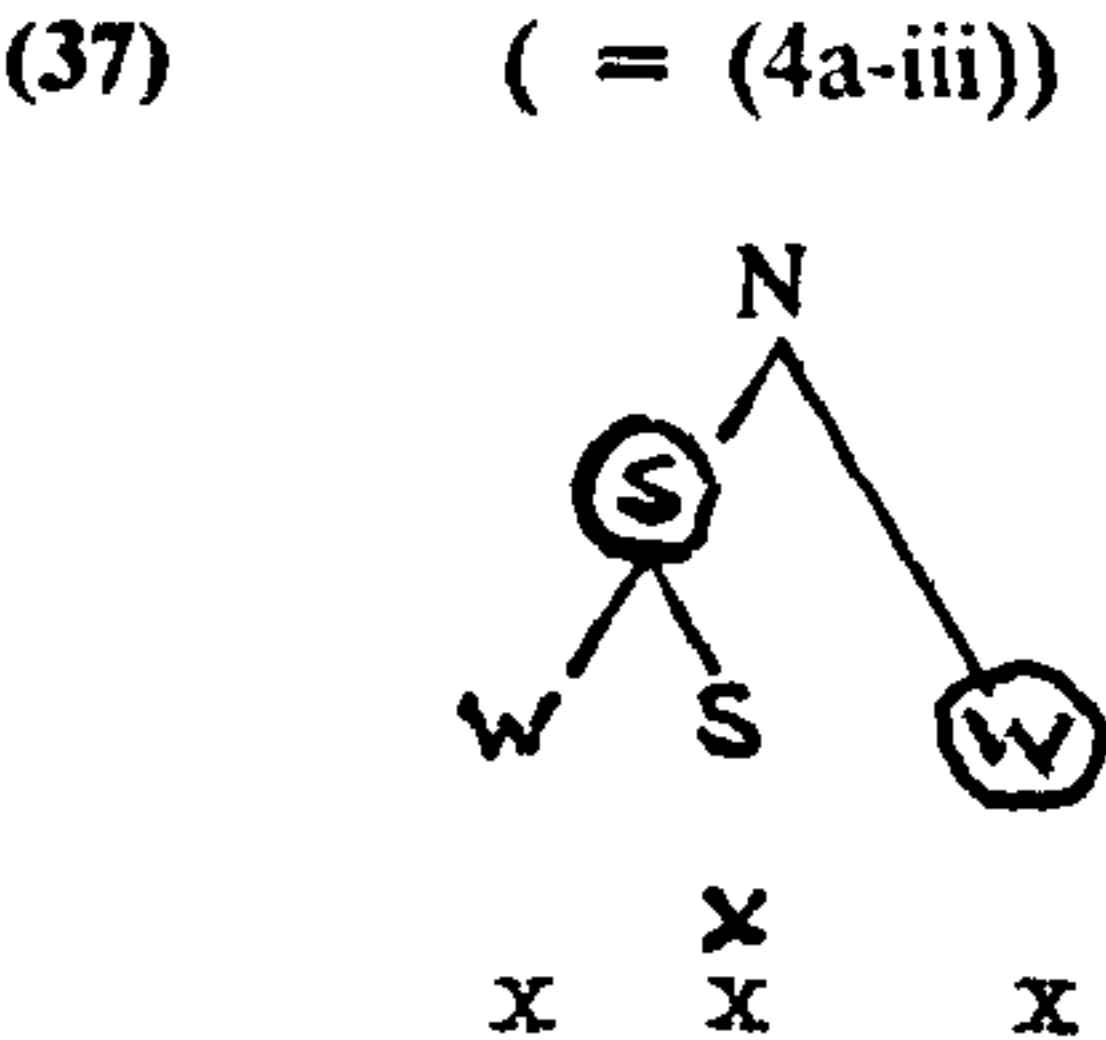
3. Four-noun compounds are given the following metrical tree and grid representations according to (29) and (30), respectively. It will be understood that the reformulated CAR (32) derives correct accentual phrasing patterns for compounds with different constituent structures (cf. (15))



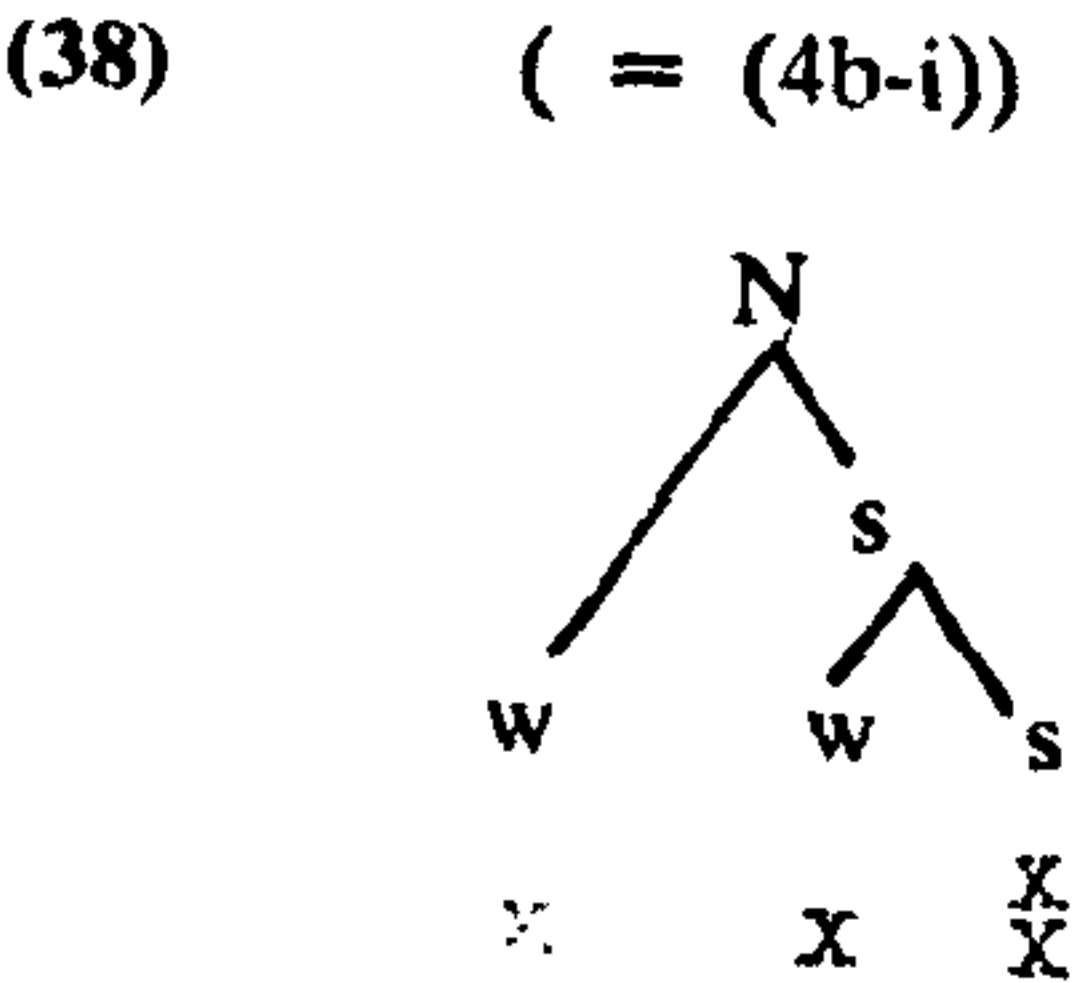
4. The restructuring I postulated as regards the marked left-branching compound nouns (i.e. (11) and (17)) is now seen not to involve a change in branching structure but to simply reflect a difference in prominence relation defined within the metrical structure of the compounds. Here, again, the reformulated CAR derives correct accentual phrasing patterns:¹⁶



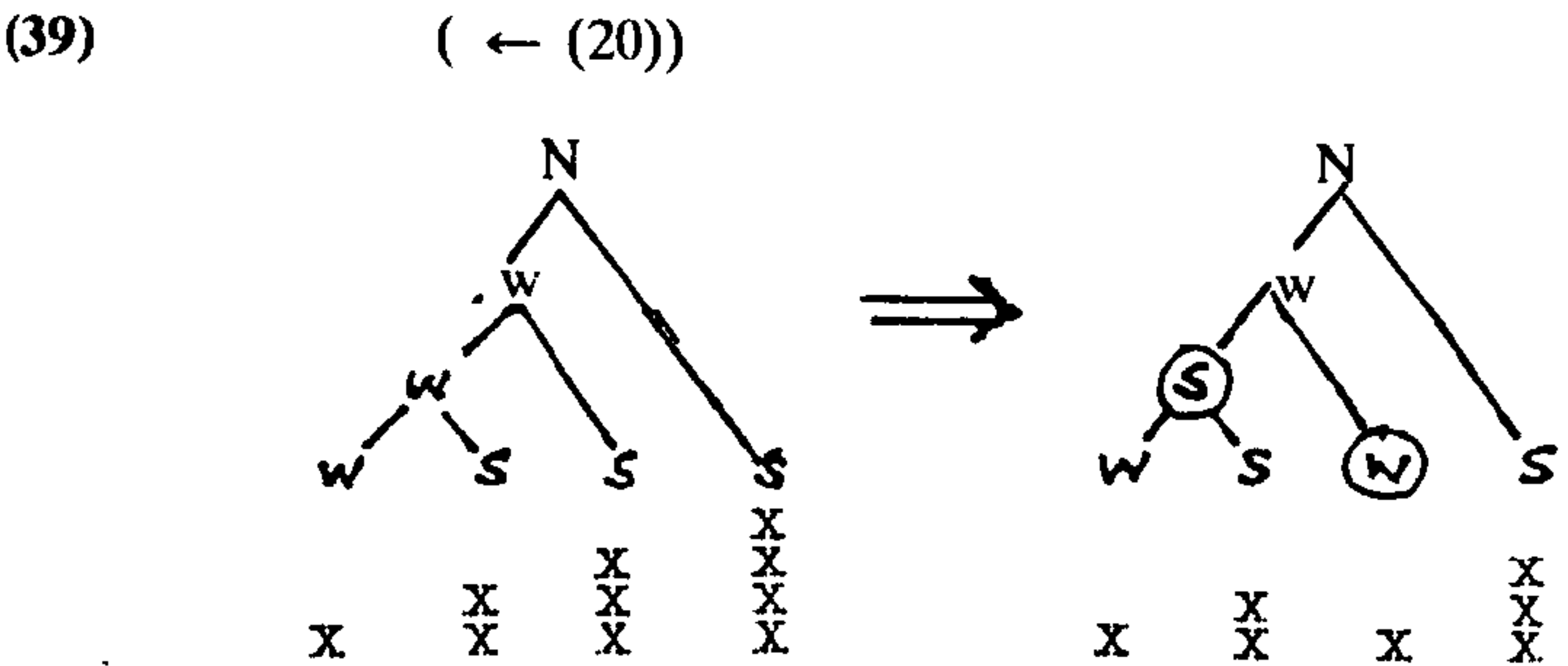
Likewise, the other marked left-branching compounds can be attributed to their deviation in metrical structure from unmarked ones:



By contrast, the accentual variation caused by pragmatic factors, i.e. (4b-i), cannot be properly expressed in metrical terms: the metrical tree structure corresponding to the variant pronunciation results in a grid like (38), which produces two accentual units according to (32):



5. Lastly, the optional accentual split mentioned in (20) is to be expressed as follows:



Seen in this light, the accentual split could be interpreted as a metrical change motivated by a certain principle of rhythmic alternation governing metrical structures.

The metrical analysis I have proposed here is quite tentative in nature and limited in scope. Nevertheless, it seems to me that this line of approach will, if pursued further, enable us to generalize otherwise inexplicable relatedness among prosodic rules in Japanese. Furthermore, it will give us new insights into the prosodic system of Japanese and, hopefully, into the intonational phonology of language in general.

Notes

1. This is a revised and extended version of the paper I read at the Postgraduate Conference in Edinburgh, on May 23, 1985. I am grateful to Bob Ladd for much discussion and valuable comments on the issues dealt with here. I am also grateful to the participants in the Conference for their suggestions as well as to those who cooperated with me as informants of Tokyo Japanese.
2. I am concerned only with Tokyo Japanese. By 'Japanese', therefore, I refer solely to Tokyo Japanese throughout the paper.
3. According to Yokoyama (1979), who analyzed the accentuation of 54,187 words listed in the Sanseido Dictionary, 28,031 words (51.2%) are lexically unaccented words, or words involving no sudden drop in pitch when pronounced in citation form.
4. There is a controversy in the literature over the location of lexical accent in Japanese, i.e. whether accent falls on vowels, morae, syllables or mora (or syllable) boundary. In this paper, I shall assume that lexical accent falls on morae, although I have no conclusive evidence to support it. Whichever view I may take does not have any bearing on the subsequent discussion in this paper.
5. Cf. Martin (1975:19); Akinaga (1966:50-54); Higurashi (1983:Ch.3).

6. To mention just a few examples:

kabuto musu → kabuto¹musu hūukei gā → hūukeiga¹
 'helmet-insect' = 'beetle' 'scene-picture' = 'landscape'
 asa yū → asa¹yū hayari uta → hayari¹uta
 'morning-hot water' = 'morning bath' 'mode-song' = 'popular song'

7. In this work, I will use *syntactic structure* and *constituent structure* interchangeably. As far as compound nouns are concerned, it seems that syntactic structure agrees with morphological and semantic structures.
8. The most serious error of Hayata's work lies in his attempt to make a generalization on the basis of a handful of examples which, to make matters worse, represent more or less exceptional cases of complex compounds (i.e. the case in (4a-ii)). Apart from this methodological inadequacy, his analysis is subject to further criticisms which we will see in passing below.
9. NHK (1966) and other existing dictionaries are of little help for the purpose of the analysis developed in this paper because of the limited number of complex compound nouns they list. Consequently, the analysis was made on the basis of the pronunciations by more than four native speakers of Tokyo Japanese.
10. Note that this statement cannot be put the other way round. That is, not all of the compounds involving a verbal noun show the accentual pattern (4a-ii) but certain idiomatic compounds show the pattern (4a-i): e.g.

bŭnka kooryuū zigyoo → bŭnkakooryuuzi¹gyoo
 'culture-exchange-scheme' = 'culture exchange scheme'

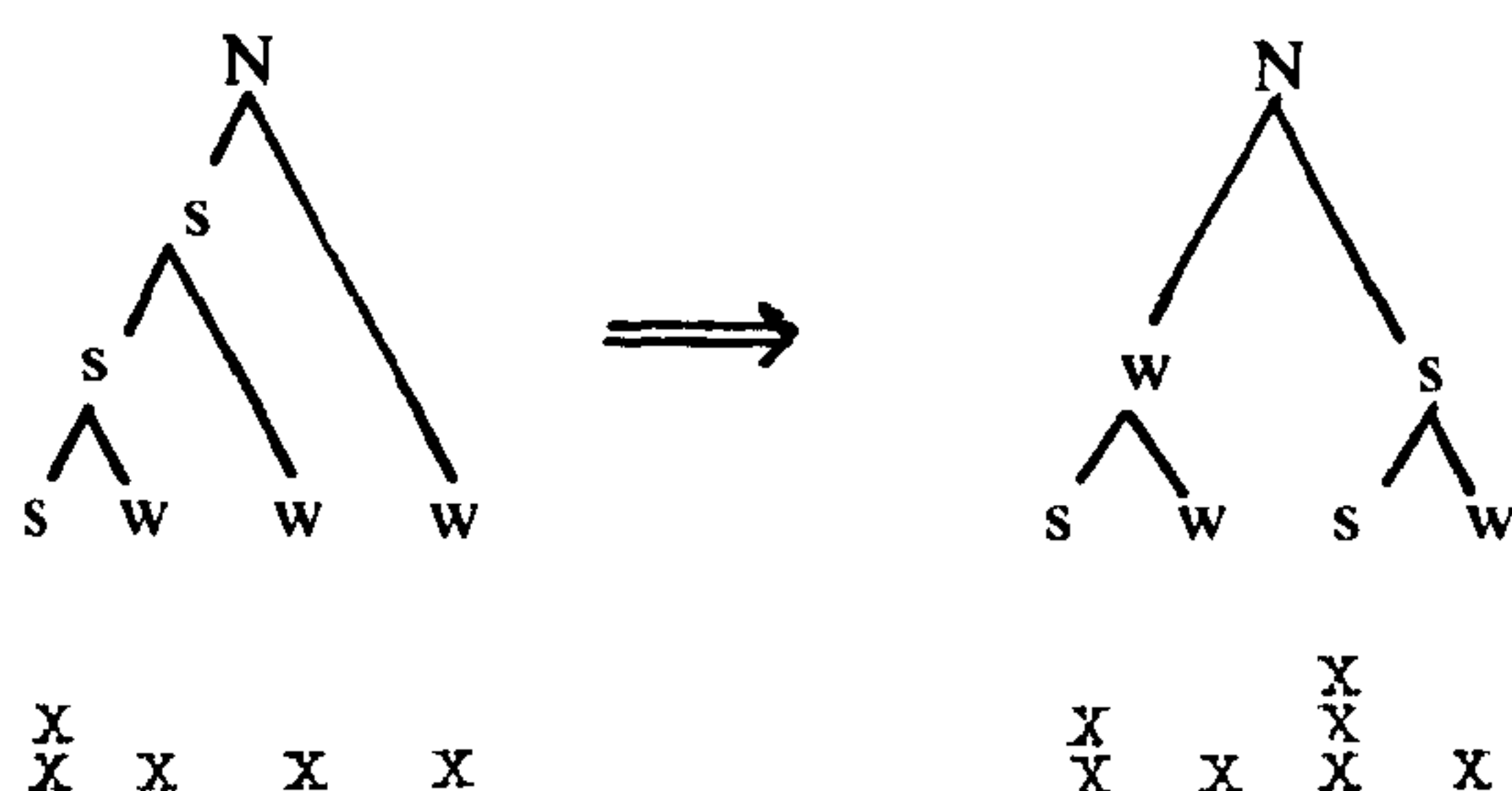
kinoo kaihukū kūnren → ki¹hookaihukukū¹ren
 'function-recovery-training' = 'rehabilitation'

zidoo huyoo tēate → zi¹loohuyoote¹hte
 'child-support-allowance' = 'child allowance'

By contrast, no such example was found with compounds involving a coordinate structure.

11. Note that both *reddo* 'red' and *sokkusu* 'socks' exist in Japanese as borrowed words on their own. By contrast, *nyuuyooku* 'New York' is ambiguous in that it can be interpreted both as a simple noun and as a compound noun. Whichever interpretation we may take, our rule derives the same accentual phrasing pattern for the whole compound, *nyuuyooku yankiizu* 'New York Yankees'.
12. It is interesting to note that a similar phenomenon is to be observed in English. According to Bob Ladd (personal communication), left-

branching four-noun compounds like *travel expense discount voucher* can get their main stress shifted on their third component word as if they had undergone a restructuring as follows:



13. I owe these terms to Ladd (1983).
14. Some caution must be shown here as we are apt to confuse the APF with the CAR. Compare, for instance, the accentual patterns of the two kinds of personal names, (a) foreign and (b) native Japanese, which are subject to CAR and APF, respectively.

- (a) mohamedō āri → mohamedo āri 'Mohammed Ali'
ronārudo rēgan → ronarudo rēgan 'Ronald Reagan'
- (b) nakasonē yasūhiro → nakasone yasuhiro 'Nakasone Yasuhiro'
miurā momoe → miura momoe 'Miura Momoe'

As is clear from these examples, the CAR applies regardless of the accentedness and accentuation of the first component word, while the APF presupposes the absence of accent in the first component word and adds no new accent even if the second word is unaccented. In other words, the CAR is an accent assignment rule that applies at the lexical level, whereas the APF is a pitch (tone) assignment rule that applies at the post-lexical level.

15. These diagrams are based on a spectrographic analysis of ten repetitions of each phrase by a female speaker. The phrases were read in the sentence frame /korewa.....desu/ 'This is.....' in no contrastive context.
16. Note as regards (36c) that the analysis based on the concept of metrical relation enables us to withdraw the condition we assumed for the restructuring rule (cf. (18)) since it involves no change in constituent structure.

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THE STRESS OF BISYLLABIC WORDS IN DUTCH: A NEW APPROACH

Paul Nieuwenhuis and Scott Allan

1. INTRODUCTION

Word-stress in Dutch has been puzzling scholars for many years. Various efforts have been made to discern a pattern of some sort in the mass of seemingly contradictory data with which the Dutch language presents us. Such attempts have left us with a legacy of well-intended but extremely complicated rules and descriptions. One problem which frustrates any attempt at finding the 'basic' rules of Dutch word-stress is the large body of borrowed vocabulary with 'deviant' stress, which effectively divides the lexicon in two. Booij (1977:63) attempts to solve this problem by giving these non-conformist items a feature [+French], while van Marle (1980) proposes a number of different patterns of stress, all operating at the same time, but covering different parts of the lexicon. The problem is that — unlike his English-speaking counterpart — the average native speaker of Dutch displays a marked tendency to pronounce any word which to him looks foreign with the appropriate 'foreign' stress. Thus, while the French word *bu'reau* was borrowed by English as *'bureau*, in Dutch it retains its French stress pattern.

If only we could exclude these foreign words we would find the 'real' underlying rules that govern stress-assignment in Dutch. A few attempts in this direction have been made by presenting Dutch speakers with unknown data. Ern  s (1949:142) analysis of the pronunciation of Javanese words by Dutch speakers is useful in this respect as is van Marle (1980:85-6) who gives examples of Turkish data pronounced by Dutch speakers. Unfortunately, neither of them develops this line of research and of course in both cases the informants are presented with distinctly foreign-looking data. In our study we have sought to avoid these problems.

2. METHODS

We realised at an early stage that in order to elicit any basic underlying rules of Dutch word-stress — if such rules indeed existed — informants had to be presented with Dutch-looking data. To avoid the problems of lexicalised stress-patterns the data could not be taken directly from the lexicon of Dutch. It was decided therefore to build the phonotactic rules of Dutch — with some refinements — into a simple computer-programme, a task which was executed for us by Norman Dryden of the Linguistics Department at Edinburgh University, whose help was invaluable in this respect. The resulting output consisted indeed of a mass of Dutch-looking data and as expected a number of existing Dutch words were also

APPENDIX III: KUBOZONO (1986)

"Speech Errors and Syllable Structure"

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Haruo Kubozono

0. Introduction

"A slip of the tongue," in the words of Boomer and Laver (1967/73), "is an involuntary deviation in performance from the speaker's current phonological, grammatical or lexical intentions." Tongue slips or speech errors (SEs) thus defined have drawn much cross-disciplinary attention as an important source of data for understanding the mechanisms of the speech production process. Linguistic research on this subject has uncovered many regularities in SEs and, thereby, has successfully shown the psychological reality of many linguistic constructs—reality of various linguistic units from phonetic feature to word as well as that of some theoretical constraints and rules. However, previous research has dealt with only a few European languages like English, German or Dutch, and little or no work has been reported on other languages (cf. Fromkin, 1973, 1980; Cutler, 1982).

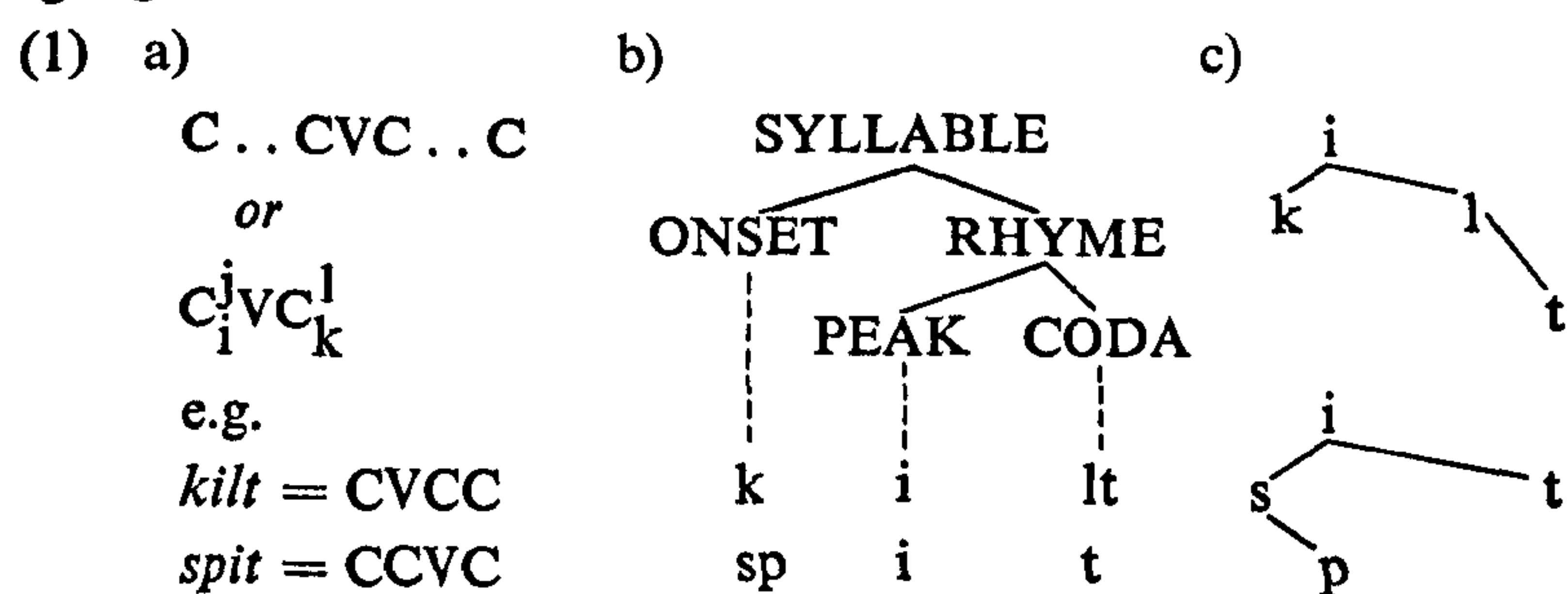
With this historical background, the present paper attempts to compare SEs of English and Japanese as regards (a) the psychological reality of syllable-size units, and (b) the internal structure of those units. The paper also discusses, in passing, some controversial issues concerning the representation of complex vowels and consonants.

1. Speech Errors and Syllable Structure in English

1.1 The concept of syllable has a long history in linguistics and phonetics (cf. Allen, 1981), and its significance is now widely recog-

nized.¹ In the case of English, for instance, Kahn (1976) has convincingly argued against Chomsky and Halle (1968) that the concept of syllable is indispensable in generalizing linguistic phenomena in the language.

While the linguistic significance of the syllable has thus been given wide recognition, the problem of its internal structure or organization has not been settled yet.² Models proposed in the literature fall into three broad types, as represented below, which have been put forward essentially for English and other European languages:



(1-a) is a model whereby the syllable is represented as a linear sequence of consonantal and vocalic elements. This notation, which is widely used in the literature (e.g. Abercrombie, 1967), provides a convenient means of simplifying phonological rules as well as of classifying languages in terms of their possible syllable types (e.g. English: CCCVCCCC or $C_0^3VC_0^3$). Despite its practical use, however, this model says nothing significant about the internal organization of the syllable, possibly except that vocalic elements are central in the unit.

The other two models, on the other hand, appear more refined in that they both assume the unit to be more or less hierarchically organized. (1-b), which is as widely adopted as (1-a) (e.g. Selkirk, 1982), is capable of capturing the important distinction between 'open syllable' and 'closed syllable'. The last syllable structure model in (1), which seems the least known of the three, was proposed by Anderson and Jones (1977) as part of their dependency phonology.

This model is based on the notion that syllable internal structures are to be expressed in relational (dominant-dependent) terms among their component segments, on the basis of the putatively universal 'sonority scale.'

While these three different syllable structure models are to be found in the literature, little serious discussion seems to have been developed on how they actually work in linguistic descriptions, much less on which model works better to that end.

1.2 Having looked at the previous treatments and general problems regarding the syllable-size unit in English, we now examine SEs in the language to see what evidence they can provide for the psychological reality of the unit and its internal structure.

By way of introduction to SEs in general, let us consider some typical errors in English. (English SEs cited in what follows are all from Fromkin (1973: 243–269), unless otherwise stated.)

- (2) a) Substitution
 - i) Anticipation: a *reading list* → a *leading list*
 - ii) Perseveration: *she* can see it → she can *she* it
- b) Transposition (Reversal; 'Spoonerism')
 - Hockett* or *Lamb* → *locket* or *ham*
- c) Omission
 - speech error → peach error
- d) Addition
 - optimal number → *m*optimal number
- e) Movement
 - dinner* at eight → inner at *date*
- f) Blend
 - Ross/Chomsky* → *Romsky*

For a better understanding and characterization of SEs, it seems desirable to distinguish between a pair of concepts, 'target' and 'origin' of errors: The former refers to the element which is interfered with by the latter and, consequently, undergoes an error. In the example in (2-a-i), *reading* is the target word while *list* is the

origin word (cf. Boomer and Laver, *ibid*: 124). It must be noted, however, that the target-origin relation is not always definable on the actual utterance. Errors classified as 'blend', for example, normally involve two words which are in a paradigmatic relation to each other. Besides these paradigmatically defined errors, we find instances, like the syllable addition/omission errors Cutler (1980) reports, whose motivation stems from the phonological context of speech.³ In such cases, the target-origin relation is difficult to define in the text despite the fact that the error itself is to be defined in the context of speech.

1.3 As mentioned above, quite a lot of work has been reported on SEs in English, where we find at least two lines of evidence which suggest the psychological reality of the syllable-size unit. One of them is the fact that a whole syllable is involved in many errors (-denotes a syllable boundary):

- (3) 1. Mor-ton and Broad-bend point → Mor-ton and Broad-point
 2. tre-men-dous-ly → tre-men-ly
 3. pop-u-la-tion/pol-lu-tion → pop-u-lu-tion
 4. pub-lic/pop-u-lar → pop-lic
 5. sur-vey/re-view → sur-view
 6. com-pli-cate/sim-plefy → com-plefy

The claim that the syllable in English is a psychologically real unit can be further, and more conclusively, substantiated by the finding that "segmental slips obey a structural law⁴ with regard to syllable-place: that is, initial segments in the origin syllable replace initial segments in the target, nuclear replace nuclear, and final replace final" (Boomer and Laver, *ibid*: 126). This finding, exemplified below, has been confirmed by many other SE studies (cf. Fromkin, 1973: 227):

- (4) 1. ma-ga-zine → ma-za-gine
 2. cor-ti-cal → cor-ki-cal
 3. Ro-man Ja-kob-son → Yo-man Ra-kob-son

4. *to-nal pho-nol-o-gy* → *fo-nal pho-nol-o-gy*
5. *ad hoc* → *odd hack*
6. *group three* → *greep three*
7. *gone to seed* → *god to seen*
8. *cup of cof-fee* → *cuff of cof-fee*

While these two lines of evidence strongly support the view that the syllable in English is not simply a linguistic construct but a real behavioral unit in speech production, English SEs reported in the literature do not seem to provide any evidence on the internal structure of the syllable, except that the unit consists of three parts: onset, nucleus and coda. In other words, no evidence can be adduced in support of either of the hierarchical syllable analyses as against the linear model in (1) above.

1.4 Apart from the evidence relating to the syllable, SE literature of English provide two interesting findings which have a crucial bearing on the discussion in what follows. One finding is that vocalic elements are never replaced by consonantal elements, or vice versa, which MacKay (1970/73) formalizes as 'Phonetic Similarity Hypothesis'. The other finding is that complex vowels of English, i.e. the co-called 'long vowels', 'diphthongs' and vowels with 'r-quality' (e.g. /ar/ [ər]), never split into two elements:

- (5) 1. *first* and *goal* to [ər...ow] → *first* and *girl* to go [ər...ər]
2. *competing rules* [ij...uw] → *computing rules* [(j)uw...uw]
3. *feet moving* [ij...uw] → [fuwt mijving]
4. *a pipe smoker* [aj...ow] → *a pope smiker* [ow...aj]
5. *fill the pool* [i...uw] → *fool the pill* [uw...i]
6. *available for exploitation* [ej...ɔj] → *avoi*lable for . . . [ɔj]
7. *brain research* [ej...ij] → [brijin rejsərtʃ]

These errors suggest that "the complex vowels are single units" in the speech production process of English (Fomkin, 1973: 223) and, moreover, could be taken as evidence to support Chomsky & Halle's abstract monosegmental analysis of complex vowels (e.g. /i/, /ē/) as against Trager & Smith (1951)'s 'nucleus+glide' analysis

(e.g. /iy/, /eh/) or Lass (1976)'s bimoraic analysis (e.g. /ii/, /ee/).

2. Speech Errors and Syllable Structure in Japanese

2.1 It is generally agreed that Japanese is among the languages which have an extremely simple syllable structure (cf. Abercrombie, *ibid*: 74–75). That this generalization oversimplifies the whole-situation over the syllable-size units in Japanese seems apparent in the light of the fact that the phonological theory of Japanese generally recognizes two phonological units between segment and morpheme, which Pike (1967) termed '(phon)etic syllable' and '(phon)emic syllable', respectively. (6) illustrates this situation with two-etic-syllable words consisting of a different number of emic syllables (- and . denote etic and emic syllable boundaries, respectively):

(6)	[gak:o:]	[gengo]	[ʃakai]	[(ʔ)asa]
	'school'	'language'	'society'	'morning'
	/gak-koo/	/gen-go/	/sja-kai/	/a-sa/
	/ga·k·ko·o/	/ge·n·go/	/sja·ka·i/	/a·sa/

As may be implicit in (6), Pike's 'etic syllable' corresponds to the concept of syllable as is generally used in the linguistic/phonetic literature: namely, it is definable in the putatively universal terms, or on the concept of 'sonority'. 'Emic syllable', by contrast, is to be defined, as its name implies, within a particular language system. In the case of Japanese, it is defined as a temporal (i.e. putatively isochronous) unit, which many linguists refer to as 'mora' (cf. Trubetzkoy, 1939/69; Ladefoged, 1975; McCawley, 1978; Beckman, 1982). In what follows, I shall use, after this latter tradition, the terms 'syllable' and 'mora' for Pike's 'etic syllable' and 'emic syllable', respectively.

The relevance of the mora thus defined has been discussed in considerable depth in Japanese phonology. Specifically, it is recognized as the standard for measuring length and distances in accentuation as well as a unit of meter in traditional poetry (cf. McCaw-

ley, *ibid*: 119).⁵

In classificatory terms, the Japanese mora is generally said to fall into two major types. /CV/, /CjV/ and morpheme initial /V/ form one class in that they can constitute a syllable on their own—I shall call this mora type ‘syllabic mora (SM)’. The other mora type, comprising /V/ and /C/, cannot constitute a syllable by itself, and appears in positions following SMs—I shall refer to this type as ‘non-syllabic mora (NSM)’.⁶ The quality of vocalic NSMs can either be the same as or different from that of its preceding vowel, constituting, respectively, what may be described as ‘long vowel’ and ‘diphthong’ in phonetics: e.g. /gakkoo/, /sjakai/. In traditional phonemic analyses (e.g. Kindaichi, 1967/81; Joo-o, 1977), they are represented as /R/ (or /H/) and /J/, respectively. Their consonantal counterparts are also of two subtypes: the so-called ‘moraic nasal’ (e.g. /gengo/) and ‘moraic obstruent’, or the first part of a long consonant (e.g. /gakkoo/). The moraic nasal, often symbolized as /N/, can appear everywhere other than morpheme-initially, and is phonetically realized as a nasal homorganic with the following consonant: e.g. [m, n, ŋ]. The moraic obstruent, traditionally symbolized as /Q/, occurs only in word-medial position and is realized as voiceless obstruent (or voiced stop in some borrowed words) homorganic with the following consonant with which it forms a long consonant.

Of the two mora types just outlined, SMs are by far the more common. (7) represents the statistical result cited in Miyajima et al. (1982: 319), which shows the frequency of each mora type and subtype in written texts comprising 40,000 morae, arbitrarily selected from Japanese newspapers and magazines:⁷

(7)	/CV/	/CjV/	/V/	/N/	/Q/	
	71.8	3.2	18.0	4.7	2.3	(%)
	SM 75%		NSM 25%			

Although an analysis of spoken forms of language might show a different result from that in (7), and for that matter, there might be a variation within different spoken forms (e.g. academic vs. non-

academic),⁸ the result in (7) can be taken as a rough approximation of the frequencies with which SMs and NSMs appear in Japanese.

Just as the mora is classified into two major types, so the syllable is generally categorized into two types: 'long syllable' (LS), which consists of two morae, SM+NSM, and 'short syllable' (SS) which comprises one mora, i.e. SM (cf. McCawley, *ibid*; Fujimura, 1972).^{9,10} Unlike the mora, however, the significance of the syllable has not been discussed in much depth. In fact, the only place where the unit has been given a status in Japanese phonology is in the descriptions of accentuation, where it is characterized as the 'bearer of accent'. This characterization is based on several accentual facts, notably that LSs provide only one possible place for accent: # . . ŒM.NSM-SM . . # can contrast with # . . SM.NSM-ŒM . . . #, but not with # . . SM.NŒM-SM . . # (cf. McCawley, *ibid*: 119; Fujimura, *ibid*: 77).

2.2 In contrast to the great interest in SEs in English, little work has been done on SEs in Japanese. To my knowledge, there are only two substantial publications on this subject: Kamio and Tonoike (1979) and Tabusa (1982), the latter of which reports more than 1,300 SEs observed in TV speech. What I intend to discuss in what follows is based on an analysis of the data provided in these publications as well as of some errors observed by myself.

SEs in Japanese show the same regularity as those in English in that they do not violate the phonotactic rules of the language. They do show, however, the following features which have not been reported in English.

- (8) 1. Complex vowels—'long vowels' and 'diphthongs'—can split into two components.
2. 'Long consonants' can also split into two parts.
3. In errors involving the splitting of these complex vowels and consonants, vowels can be replaced by consonants, and vice versa.
4. Long syllables are generally not replaced by short

syllables.

The first three features can be exemplified by the following errors (- denotes a syllable boundary):¹¹

(9) a) Substitution

1. *kaa-taa dai-too-rjoo* → *kai-taa dai-too-rjoo* 'President Carter'
2. *moo-taa bai-ku* → *moi-taa bai-ku* 'motor-bike'
3. *koo-zui tjoo-i-hoo* → *koo-zuu tjoo-i-hoo* 'flood warning'
4. *bei-tjuu kan-kei* → *bei-tjuu kai-kei* 'China-US relation'
5. *bon sai-ban-tjoo* → *bon san-ban-tjoo* 'Chief Justice Bon'
6. *zjuu-go paa-sen-to* → *zjuu-go pan-sen-to* '15 per cent'
7. *sai-sjuu dan-kai* → *sai-sjun dan-kai* 'last stage'
8. *koo-tjan hu-ku-kai-tjoo* → *koo-tjaa hu-ku-kai-tjoo* 'Deputy Chairman Korchan'
9. *kuu-bo mid-do-sei* → *kub-bo mid-do-wei* 'Aircraft Carrier Midway'
10. *zin-ken mon-dai de ko-mat-te iru* → ... *ko-man-te iru* 'troubled with the problem of human rights'

b) Transposition

1. *dan-gai sai-ban-sjo* → *dai-gan sai-ban-sjo* 'Court of Impeachment'
2. *kan-kei kai-zen* → *kai-ken kai-zen* 'improvement in relationship'

c) Blend

1. *muu-do/hun-iki* 'mood/atmosphere' → *mun-iki*
2. *to-ma-re/su-top-pu* 'stop (imperative)' → *to-map-pu*

A glance at these errors might give the impression that Japanese SEs are of a totally different nature from the English counterparts. Indeed, as long as we stick fast to the syllable structure models as in (1), we feel tempted to think that Japanese SEs occur in an un-

predictable, unstructured manner. Given the conception of the mora as a behavioral unit in the language, however, we can provide a principled and satisfactory account for all the errors in (9). (A dot represents a mora boundary while the target and origin of an error are denoted in *italics* and in **bold face** respectively):^{12,13}

(10) a) Substitution

1. ka·*a*·ta·a da·*i*·to·o·rjo·o → ka·*i*·ta·a da·*i*·to·o·rjo·o
2. mo·*o*·ta·a ba·*i*·ku → mo·*i*·ta·a ba·*i*·ku
3. ko·*o*·zu·*i* tju·*u*·i·ho·o → ko·*o*·zu·*u* tju·*u*·i·ho·o
4. be·*i*·tju·u ka·*n*·ke·*i* → be·*i*·tju·u ka·*i*·ke·*i*
5. bo·*n* sa·*i*·ba·*n*·tjo·o → bo·*n* sa·*n*·ba·*n*·tjo·o
6. zju·*u*·go pa·*a*·se·*n*·to → zju·*u*·go pa·*n*·se·*n*·to
7. sa·*i*·sju·*u* da·*n*·ka·*i* → sa·*i*·sju·*n* da·*n*·ka·*i*
8. ko·*o*·tja·*n* hu·ku·ka·*i*·tjo·o → ko·*o*·tja·*a*
hu·ku·ka·*i*·tjo·o
9. ku·*u*·bo mi·*d*·do·we·*i* → ku·*b*·bo mi·*d*·do·we·*i*
10. zi·*n*·ke·*n* mo·*n*·da·*i* de ko·ma·*t*·te i·ru → . . . ko·ma·*n*·te i·ru

b) Transposition

1. da·*n*·ga·*i* sa·*i*·ba·*n*·sjo → da·*i*·ga·*n* sa·*i*·ba·*n*·sjo
2. ka·*n*·ke·*i* ka·*i*·ze·*n* → ka·*i*·ke·*n* ka·*i*·ze·*n*

c) Blend

1. mu·*u*·do / hu·*n*·i·ki → mu·*n*·i·ki
2. to·ma·re / su·*to*·p·pu → to·ma·p·pu

Under this analysis, the splitting of complex vowels and consonants is seen as a result of errors involving the substitution, transposition, etc. of moraic units constituting those complex sequences. Likewise, vowel-consonant replacement errors are to be interpreted not as segmental errors but as moraic errors involving a moraic vowel and a moraic consonant. And this interpretation explains why errors like /a·t·ta/ 'was, met' → /ta·ta/ or /a·i·ro·n/ 'iron' → /ni·ro·n/ are not to be found in Japanese even though the resulting sequences perfectly satisfy the phonotactic rules of the language.

The claim that the mora is a psychologically real unit in Japanese

is further substantiated by the fourth finding in (8). Consider (11) and Table 1, which respectively show the three types of errors involving the substitution/transposition of a whole long syllable, and the relative frequencies with which they occurred:

- (11) a) *se-kai ren-poo sin-bun* → *se-kai ren-bun sin-bun*
 'World Federation Newspaper'
 b) *kjoo-no ki-ku-ziroo* → *ku-ku-no ku-ku-zi-roo*
 'Kyoono Kikuziroo (personal name)'
 c) *kjo-nen . . . rai-nen* → *kjo-nen . . . kjo-nen*
 'last year . . . next year'

Table 1

Origin of LS Replacement Errors

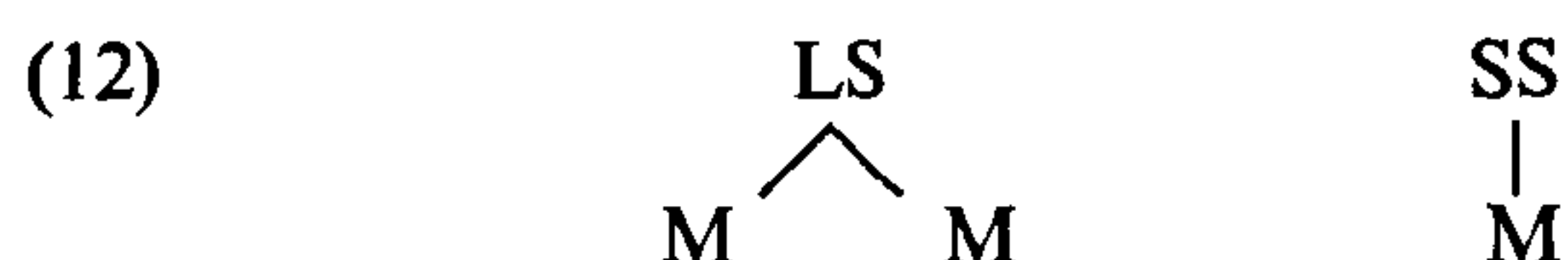
Type (a)	Long Syllable	41	(64%)
Type (b)	Two Short Syllables	14	(22%)
Type (c)	One Short Syllable	9	(14%)
Total		64	(100%)

Table 1 provides two important facts to be considered concerning the relation between the two types of syllables. Firstly, it reveals that a long syllable is replaced by another long syllable more than four times as often as by a single short syllable (i.e. 41 errors vs. 9 errors). In the light of the corollary mentioned earlier that short syllables occur twice as often as long syllables in Japanese (cf. Note 10), this result seems to be sufficient evidence to state that long syllables tend to be replaced by long syllables, and not by short syllables.

The second and more important fact to be noted with Table 1 is that quite a few errors involve the replacement of a long syllable by two successive short syllables. In fact, errors of this type (i.e. type (b)) account for more instances than errors of type (c) in which a long syllable was replaced by a single short syllable.¹⁴

These two facts can be understood in a straightforward manner if the mora is recognized as a relevant temporal unit. Namely, a long syllable tends to be replaced by another long syllable or a sequence

of two short syllables rather than by a single short syllable because the 'syllable weight' of a long syllable is double that of a short syllable:



In sum, the few lines of evidence discussed so far strongly suggest that the mora is not simply a linguistic construct but is a psychologically real unit which plays a crucial role in regulating the temporal structure of Japanese utterances.

2.3 While it seems plausible to conclude, then, that the mora has independent status as a behavioral unit in Japanese, this does not negate the possibility that the syllable is also a relevant unit in the speech production of the language. We have already seen errors, for instance, in which a whole long syllable is replaced (cf. (11)). In addition to these, we find errors involving the omission, transposition, etc. of a whole syllable, both (a) a long syllable and (b) a short syllable:¹⁵

- (13) (a) 1. ba-su-ket-to-*boo*-ru → ba-su-ket-to-ru
 'basketball'
 2. boo *oo*-ku-ra dai-zin → boo-ku-ra dai-zin
 'Finance Minister Mr. Boo'
 3. sei-ken *koo*-tai → sei-ken *tai*-koo '(political)
 power change'
 4. min-kan *kuu*-koo → min-kan *koo*-kuu
 'civil airport'
- (b) 1. kai-mo-*no*-kja-ku → kai-mo-kja-ku 'shoppers'
 2. *ri*-su → *su*-ri 'squirrel'
 3. ti-ma-*mi*-re-ni nat-te → ti-ma-*re*-mi-ni nat-te
 'smeared with blood'
 4. ka-ti-ku → ka-*ku*-ti-ku 'livestock'

The claim that the syllable is a psychologically real unit is further confirmed and reinforced by a structural law which moraic errors

are observed to obey with respect to syllable-place. Consider Table 2 below, which shows the origin element by which the second mora of a long syllable, or NSM, was replaced in substitution and transposition errors in our corpus:^{16,17}

Table 2
Origin of NSM Replacement Errors

	NSM	SM
Substitution	75	8
Transposition	4	1
Total	79 (90%)	9 (10%)

In 88 errors analyzed, only nine instances (10%) involve the replacement of a NSM by a SM, the rest involving the replacement of a NSM by another NSM. Seen in the light of the statistical result in which NSMs and SMs are reported to appear by the ratio 1:3 (cf. (7)), it can safely be concluded that NSMs are replaced by NSMs much more frequently than would be expected by chance.¹⁸

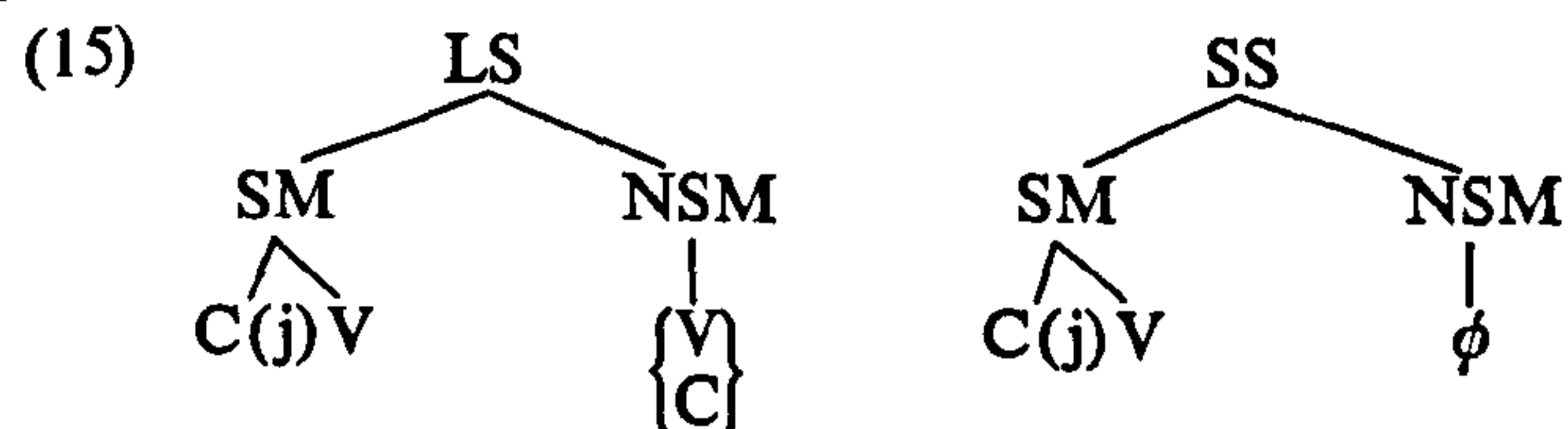
Meanwhile, interaction between two SMs is common, regardless of whether they belong to (a) the same syllable type (i.e. long syllable—long syllable, short syllable—short syllable), or (b) different types (i.e. long syllable—short syllable):¹⁹

- (14) (a) 1. *sai-kin no kei-koo* → *sai-ken no kei-koo*
'current trend'
2. *sa-ku-bun-sjuu . . . waa-ru-do kap-pu* → *sa-ku-wan-sjuu . . .* 'essays . . . world-cup'
3. *muu-do/hun-iki* → *mun-iki* 'mood/atmosphere'
4. *to-ri-ya-me-ru* → *to-ri-ya-ri-ru* 'cancel'
5. *bo-si hu-ku-si nen-kin* → *bo-ku hu-ku-si . . .*
'welfare pension for (a family of) mother and child'
(b) 1. *si-ma-ne su-mon so-sjoo* → *si-ma-ne su-man . . .*
'Simane (placename) Sumon Lawsuit'
2. *ri-haa-sa-ru* → *ri-saa-ha-ru* 'rehearsal'
3. *sei-zi si-kin* → *sei-zi ki-sin* 'political fund''

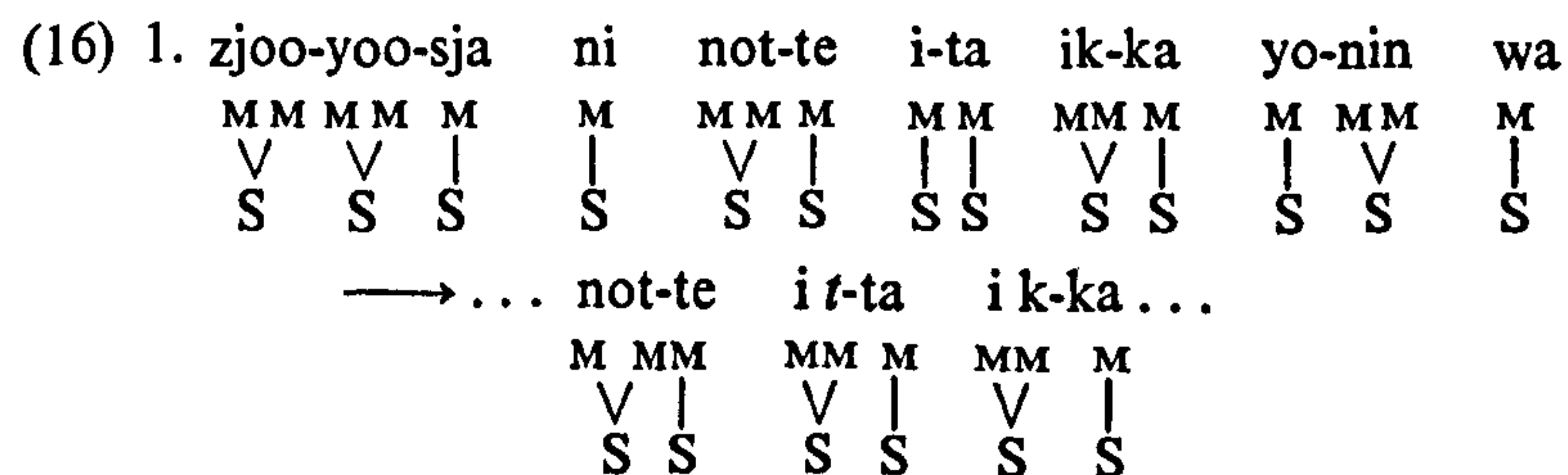
4. *ta-ku-sii/hai-yaa* → *tai-yaa* 'taxi/hire'
5. *to-da-na/hon-da-na* → *ton-da-na* 'cupboard/
book-shelf'
6. *tai-da/tai-man* → *tai-dan* 'laziness/neglect'

The results in Table 2 and (14) show that the target and origin of an error belong to the same mora type: SMs (or segments constituting SMs) in the origin syllable replace SMs (or segments constituting SMs) in the target, NSMs replace NSMs. This structural law, which crucially resembles the English counterpart cited earlier, confirms that the syllable is a psychologically real unit for speakers of Japanese.

In addition to this, the structural law with respect to syllable-place provides crucial insight into the internal structure of Japanese syllables, an implication that short syllables share with long syllables the bimoraic underlying structure, of which the NSM slot shows up unfilled at the surface:



This syllable analysis enables us not only to generalize the syllable structure of the language but also to handle the following NSM addition errors (or 'lengthening' of a short syllable to a long syllable) in a straightforward manner:



'a family of four travelling in a car ...'



Thus, given the syllable structure model in (15), these errors can be interpreted as cases where the empty NSM slot has been filled by a non-syllabic element due to some contextual analogy.

Apart from these lines of evidence from SEs, there are a number of pieces of evidence in Japanese phonology that suggest that the bimoraic syllable structure is indeed the canonical syllable configuration in the language.²⁰ I shall discuss this issue in another article.

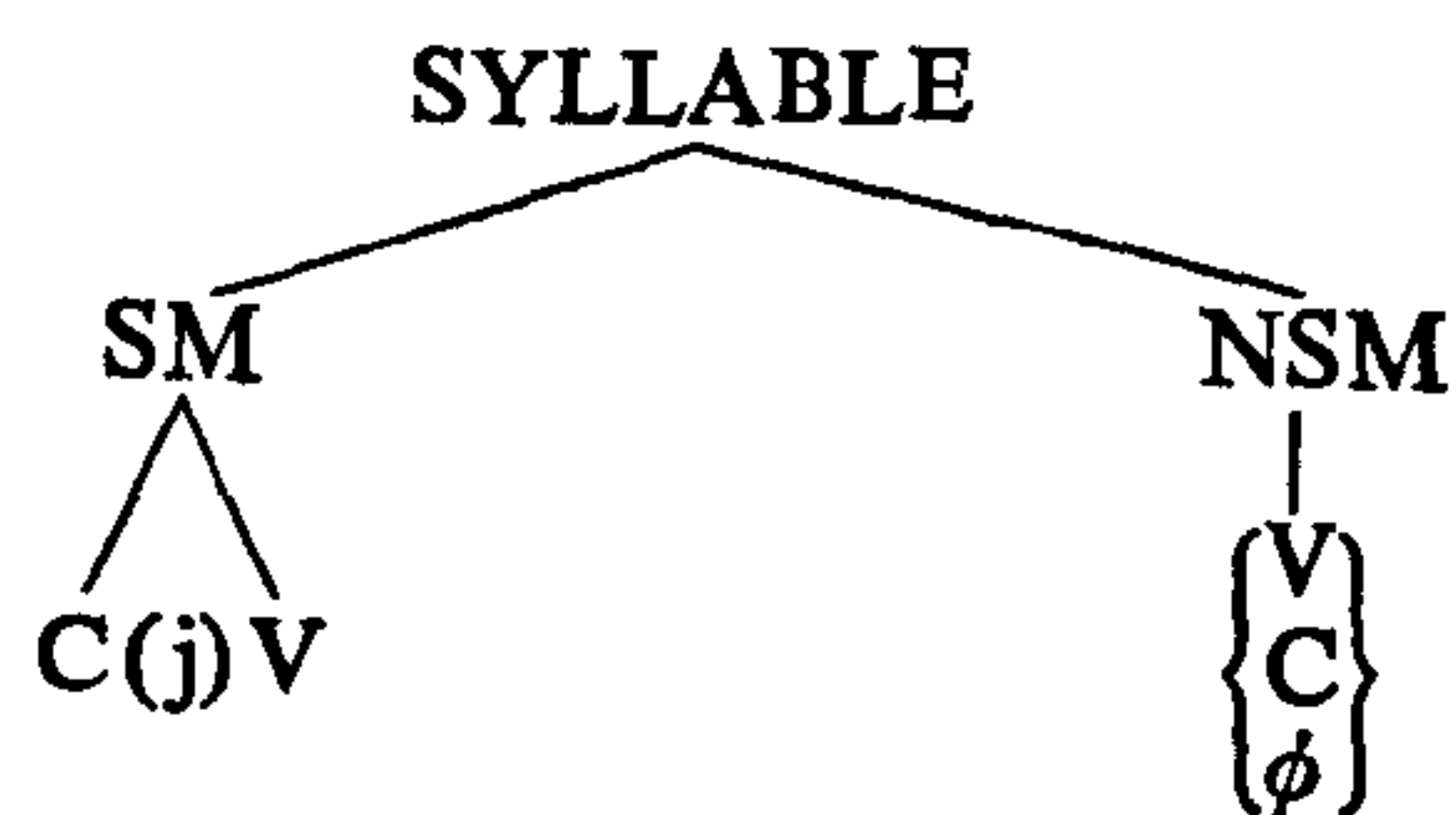
3. Conclusion

In this paper, I have discussed the evidence from SEs in English and Japanese in terms of the insight it can throw into the psychological reality of syllable-size units and their internal structure. The following summarizes the main points discussed as well as some theoretical implications for future work.

1. Evidence from the SE data both in English and Japanese suggest that the syllable is not simply a linguistic construct but is an independent behavioral unit in the production of speech, for speakers of the two languages. SE data of Japanese provide additional evidence that the mora has a psychological reality as a unit regulating the temporal structure of Japanese utterances.
2. While SE evidence suggests that the syllable has a psychological reality both for speakers of English and of Japanese, it makes a different suggestion regarding the internal structure of the unit. Evidence from English SEs, on one hand, supports the tripartite view of the unit, i.e. that the syllable consists of three constituents, onset-nucleus-coda, although it provides no implication for its hierarchical organization. The Japanese counterpart, on the other hand, suggests a hierarchical organization of the unit in which the mora forms an independent level between the syllable level and the segment level. Thus, evidence from SEs confirms that the internal structure of the syllabic unit can vary from one

language to another.

3. Although we must assume different syllable internal structures for English and Japanese, it was observed that SEs obey a structural law with respect to syllable place in both languages.
4. Evidence from SEs suggests that the two syllable types in Japanese, i.e. short (monomoraic) syllable and long (bi-moraic) syllable, represent two subcases of a single underlying structure, as schematized below:



5. This syllabic analysis suggests that the Japanese syllable constitutes a rhythmic unit of some sort which is characterized by the alternation between a strong element (syllabic mora) and a weak element (non-syllabic mora). If this is the case, it means that Japanese utterances are temporally regulated, at least at the underlying level, by the principle of 'syllabic rhythm' as well as by that of mora-timing. This hypothesis has an important implication for rhythm theory of Japanese in suggesting the possibility that Japanese morae might be hierarchically organized.

Acknowledgements

I owe much to Dr. Robert Ladd and Dr. John Laver, of the Department of Linguistics, Edinburgh University, for valuable comments and discussion on an earlier version of this paper. Responsibility for the views expressed remains mine alone.

Notes

1. Note, however, that there is no satisfactory language-universal definition of the unit. See Gimson (1968/80: 56–7) and Ladefoged (1975: 219–24) for the discussion of inadequacies of the two currently adopted syllable theories, ‘sonority theory’ and ‘pulse theory’.
2. See Selkirk (1982) and the references cited therein for metrical analyses of syllable internal structure. I shall not discuss the problem of syllabification in this paper, although it is admittedly unseparable from that of syllable structure.
3. Cutler argues that certain kinds of SEs, notably syllable omission and addition errors, tend to produce a more rhythmical utterance than the target one in such a way that the resulting utterance tends to have a more equal number of syllables between stresses than the intended utterance (/ denotes a foot boundary) (Cutler, *ibid*: 186):
 1. Target (intended) utterance:
 /Néxt we/ háve this bícen /ténial/ rúg.
 Error (resulting) utterance:
 /Néxt we/ háve this bi /cénial/ rúg.
 2. T: /Thát’s trans/ áctional an/ álysis.
 E: /Thát’s transan/ áctional an/ álysis.
4. ‘Law’ as used by Boomer and Laver is to be understood in a statistical sense, not in an absolute sense. In other words, it admits of some exceptions like the following: whisper → whipser, ask → aks, fish → shiff.
5. Note that there is still a controversy over the phonetic reality of the mora. See Beckman (1982) and the references cited therein for a detailed discussion.
6. It may deserve adding that NSMs were all introduced from Chinese (cf. Joo-o, 1977: 115). Accordingly, they are found in Sino-Japanese morphemes much more often than in native Japanese morphemes.
7. This statistical study groups morpheme-initial Vs together with

vocalic NSMs, not with the other SMs. The rate of NSMs as against that of SMs should, therefore, be lower than the one given in (7).

8. Since academic speech tends to employ Sino-Japanese morphemes more often than does non-academic speech, it is expected that the frequency of NSMs should increase as the speech becomes more academic or technical (cf. Note 6).
9. Note that some scholars exceptionally admit of 'overlong' (or 'superheavy') syllables in (a) inflected verbal forms (b) onomatopoeic words, and (c) borrowed words (cf. Joo-o, *ibid*: 114; Poser, 1984: 26-8):

(a) koot-ta 'freeze' (past); hait-ta-ra 'enter' (conditional)

(b) oop-pi-ra 'openly'; goot-to (a rubbing sound)

(c) gu-riin 'green'; tjeen-su-to-a 'chain store'

I am rather reluctant to accept this analysis for two reasons. Firstly, at least some of these 'overlong' syllables are decomposed into two syllables (short syllable plus long syllable) in actual pronunciation by many people: e.g. /koot-ta/ → /ko-ot-ta/, /oop-pi-ra/ → /o-op-pi-ra/. Secondly, there are several seemingly independent processes in Japanese phonology which 'conspire' to convert an overlong syllable to a long syllable or to avoid the occurrence of an overlong syllable (cf. Note 20 below).

10. Given the notion that Japanese does not generally admit of overlong syllables, a corollary from the statistical result in (7) would be that short syllables and long syllables occur at the approximate rate of 2: 1 in the language:

$$\begin{array}{llll}
 \text{i.e.} & \begin{array}{c} \text{LS} \\ \diagup \quad \diagdown \\ \text{SM} \quad \text{NSM} \end{array} & \begin{array}{c} \text{SS} \\ | \\ \text{SM} \end{array} & \begin{array}{c} \text{SS} \\ | \\ \text{SM} \end{array} & \begin{array}{l} \text{SS: LS}=2: 1 \\ \text{SM: NSM}=3: 1 \end{array}
 \end{array}$$

11. In order to avoid complexity and subsequent confusion, phonemic transcriptions are employed here. Note, specifically, that archiphonemic representations as adopted in traditional phonemic analyses, i.e. /R/, /J/, /N/ and /Q/, are not used so that the argument might not become circular. Besides, [ei] is repre-

- (a) 1. do-ku-*sjuu*-sjo → do-ku-sjoo-sjo 'teach-yourself book'
*do-ku-sjou-sjo
2. noo-be-ru hei-wa-sjoo →
nee-be-ru hei-wa-sjoo 'Nobel Peace Prize'
*neo-be-ru . . .
3. tjoo-sen sen-*soo* → tjoo-sen sen-soo 'Korean War'
*sen-seo
- (b) 1. ren-zo-ku *yuu*-sjoo →
ren-zo-ku yoo-sjoo 'consecutive victories'
*yuo-sjoo *you-sjoo
2. si-zjoo ni kai-*njuu* →
si-zjoo no kai-njoo 'intervene in the market'
*kai-njou *kai-njuo
3. gu-ree-pu hu-ruu-tu →
gu-ruu-pu hu-ruu-tu 'grapefruit'
*gu-reu-pu *gu-rue-pu

All these phenomena support the view that the mental representation of long vowels should be something like /VR/ (e.g. /iR/, /aR/) of which the second element is of an archiphonemic nature. It must be noted, however, that this argument does not necessarily imply that such an abstract element as //R// should be integrated as part of phonemic representation of speech, as was supposed by many linguists and phoneticians (e.g. Kindaichi, *ibid*; Fujimura, *ibid*; Joo-o, *ibid*, to mention just a few). Rather, it seems more plausible to assume that the speech production process involves a more abstract level than that of phoneme where //R// is characterized as a moraic unit, not as a segment.

13. The error in (10-a-9) seems to suggest that at the level of speech production where moraic errors occur, the moraic consonant is specified simply as an obstruent, while other features like those for the place of articulation are specified at a later, less abstract stage. Alternatively, the error may suggest that errors that violate phonotactic rules are corrected after the substitution occurs, as in the following:

/kuu-bo mid-do-wei/ → /kud-bo mid-do-wei/
 → [kub: o mid-do-wei]

14. It is interesting to note that errors of (11-c) type mostly involve, as target and origin, two synonymous words appearing in the same utterance. This suggest that substitution errors between a long syllable and a short syllable can be explained on semantic grounds as well as on phonetic grounds.
15. Needless to say, errors involving a whole syllable can also be interpreted as moraic errors.
16. The following table shows the same result in more detail. (For notational convenience, I employ the archiphonemic representations outlined in §2.1):

Table 3
Origin of NSM Replacement Errors (details)
a) Substitution Errors

origin target	/R/	/J/	/N/	/Q/	/CV/	
/R/	0	3	8	1	2	14
/J/	1	0	33	0	6	40
/N/	4	24	0	0	0	28
/Q/	0	0	1	0	0	1
Total	5	27	42	1	8	83

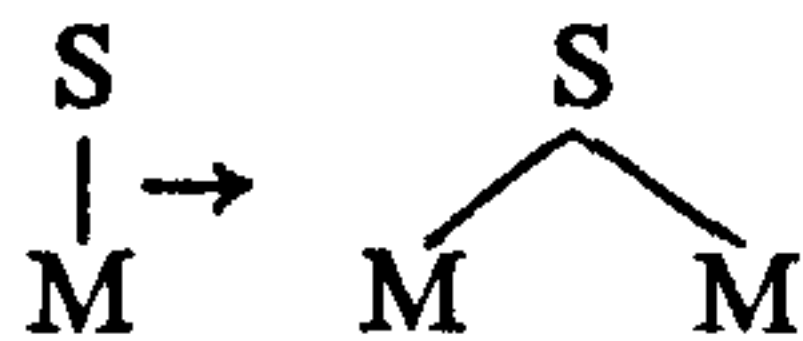
b) Transposition Errors

/J/	↔	/N/	4
/N/	↔	/CV/	1
			5

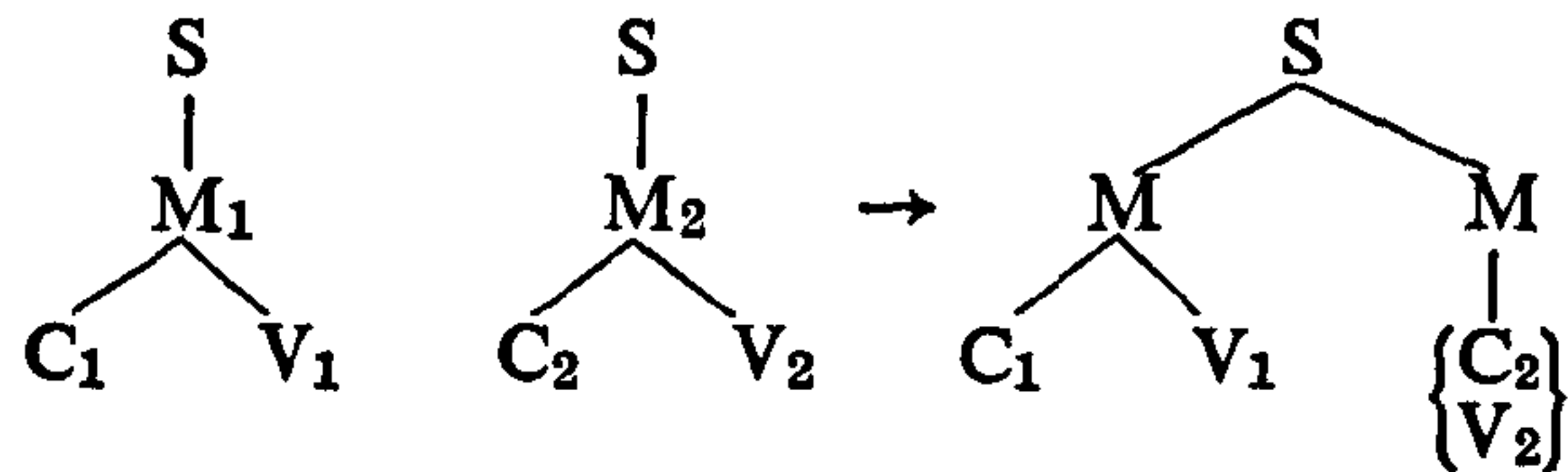
17. It may be worth citing Joo-o's observation that the four types of NSMs show within them either (a) a morphophonemic alteration, (b) stylistic variation or (c) dialectal variation (Joo-o, *ibid*: 118): e.g. (a) /*man-na-ka*/ 'midst'~/*mak-ku-ro*/ 'deep-black', (b) /*tei-nei*/~/*tee-nee*/ 'politeness', (c) /*sjoo-ben*/~/*sjon-ben*/ 'piss'.
18. Given this tendency, some may be inclined to think that it is due to the fact that NSMs are allowed to appear in restricted environments. This account can be easily refuted since Table 2 analyzes only those errors where NSMs are involved as targets, i.e. errors in which NSMs are replaced by other elements. Since no environmental constraint is thus conceivable, we are led to believe that the result in Table 2 must be attributed to a structural reason of some sort.
19. Errors in (14-b) can be interpreted either as segmental errors or as moraic errors. Whichever interpretation may be taken, however, the fact remains that these errors obey the structural law to be discussed below.
20. While few, if any, processes in Japanese phonology have the

effect of turning a long syllable into a short syllable or an overlong syllable, there are a number of processes—morphophonological, or phonetic—which ‘conspire’ to increase the number of long syllables at the expense of the other two syllable types. These processes fall into three major categories:

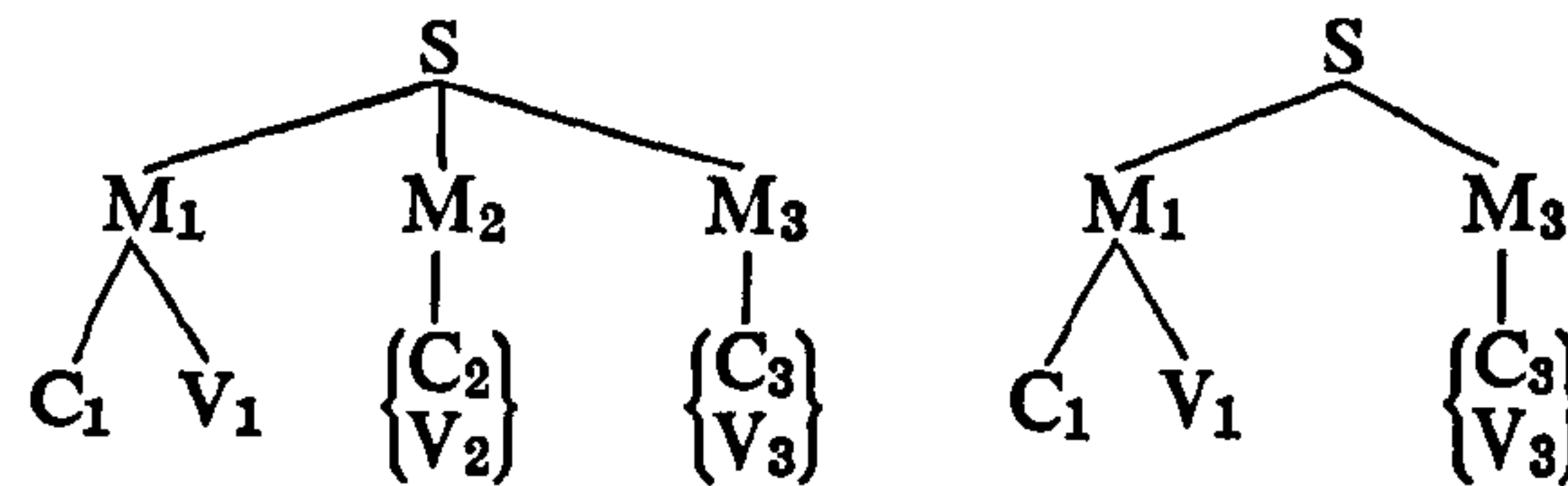
(a) Short syllable lengthening (NSM insertion) process:



(b) Syllable unification (vowel/consonant deletion) process:



(c) Overlong syllable shortening (NSM deletion) process:



In other words, by recognizing the bimoraic syllable structure as a more preferred syllable shape in Japanese, we can capture the functional relatedness among various seemingly unrelated processes.

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日本語複合語の意味構造と韻律構造

窪 園 晴 夫

APPENDIX IV: KUBOZONO (1987^a)

"On the semantics and prosody
of Japanese compounds"

Academia No.43.

日本語複合語の意味構造と韻律構造^{〈注1〉}

窪 園 晴 夫

ABSTRACT

This paper discusses several topics concerning what I call the “semantic constraint” on Japanese compounds, a constraint which blocks the prosodic compound formation process in the language. The main discussion starts with the claim that there are two types of compounds in Japanese, “compounding compounds,” to which the prosodic compound rule readily applies, and “non-compounding compounds”, which somehow fail to undergo the process. After justifying this position, I will attempt to make a detailed examination of the marked semantic structures constituting the “semantic constraint,” which are responsible for the second type of compounds. I will also show the fact that the compound formation process in English admits of exceptions which are significantly similar to those of Japanese.

The second part of the paper focuses on the nature and role of the “semantic constraint” in “complex” compound nouns, or compound nouns consisting of three or more elements. It will be shown that this constraint enables us to uncover the regularities which these compounds exhibit in accentual patterning.

1. 序

複合語化過程 (compound formation process, compounding process) とは、周知の通り、2語(以上)の連続を音韻・意味・統語・形態それぞれの面で1語とする過程である。例えば英語の場合、名詞句などの「句表現」が第二要素に主強勢 (main stress) の置かれる強勢型 (stress pattern) ——すなわち“phrasal stress pattern”——をもつのに対し、複合名詞などの「複合語」は、単純語と同じく強勢を語の前半に置こうとする傾向を示し、第一要素に主強勢をもつようになる (cf. Fudge, 1984)。black board (黒い板), blackboard (黒板) という名詞句・複合名詞の対を例にとり、主強勢の置かれる要素を大文字で表わしてみると、夫々 (1b), (1a) のような強勢型となる (本稿では以下、同じ表記法を用いる)。

- (1) a) [BLACK board]_N b) [black BOARD]_{NP}

意味的にも、「句表現」が構成要素のもつ夫々の意味をそのまま表すのに対し、「複合語」は第一要素が第二要素 (head) の表わす概念を下位範疇化 (subcategorize) し、単純語同様、単一概念を表わすようになる。加えて、統語的にも、「句表現」が *very black board*, *black wooden board* というように部分修飾語による表現の一部のみの修飾を許すのに対し、「複合語」の方は単純語に似て、そのような部分修飾を許さない——**very blackboard*, **blackwoodenboard* (cf. Bolinger, 1968; Fudge, *ibid.*)。

日本語の複合語についても基本的に同じことが言える。例えば、「赤い鉛筆」・「青い写真」といった名詞句表現が構成要素の語アクセント形式 (word accent pattern) に何ら変化を受けないのに対し (i. e. (2b)), 対応する複合名詞「赤鉛筆」・「青写真」は、アクセントの消去・付加規則——複合語アクセント規則 (Compound Accent Rule: CAR) ——の適用を受け

ることにより、(最高) 1つのアクセントしかもたない一定のアクセント形式——複合語アクセント形式 (compound accent pattern): (2a) ——を示すようになる。²⁾ (本稿では語アクセント (位置) を “^ˈ” で表わす。無印の語は無アクセント語 (平板型) を意味する)。³⁾

- (2) a) アカエ^ˈンピツ (＜ア^ˈカ + エンピツ)
アオジャ^ˈシン (＜ア^ˈオ + シャシン)
b) アカイ エンピツ (＜アカイ + エンピツ)
アオ^ˈイ シャシン (＜アオ^ˈイ + シャシン)

形態上も、句表現が構成要素の形態をそのまま維持するのに対し、複合語は第一要素が名詞化 (nominalization) の変化を受け⁴⁾ (e. g. アカイ＞アカ, アオイ＞アオ), 全体が「名詞形＋名詞形」の結合形態をもつようになる。また意味的にも、上にあげた英語の例に似た「意味の下位範疇化」もしくは「特殊化」といった変化を伴い、1語としての特徴を備えるようになる。⁵⁾

このように、複合語は、形態・意味・音韻・統語特徴といった点において句構造と峻別されるのであるが、このような複数個の基準が常に一致するわけではない。例えば、(3a) (3b) に示す例は、いずれも形態上の基準からは、名詞形と名詞形の結合という意味で共に複合名詞と見做されるべきものであり、また、意味構造からも違いはないと思われるが、音韻的には (3a) が (2a) のような複合語アクセント形式を持つのに対し、(3b) は、複合語アクセント規則 (CAR) の適用を受けずに、各構成要素の語アクセント形式が維持されるアクセント形式——句アクセント形式 (phrasal accent pattern) ——をもつ。つまり、(3b) は形態上の基準からは複合名詞としての特徴と持ち、音韻上の基準からは名詞句構造の特徴を持っているのである。

- (3) a) ユクエフ^ˈメイ (行方不明)
＜ユクエ + フメイ

- キオクソーシツ (記憶喪失)
 <キオク + ソーシツ
 セダイコータイ (世代交代)
 <セダイ + コータイ
 b) イシキ フメイ (意識不明)
 <イシキ + フメイ
 ジシン ソーシツ (自信喪失)
 <ジシン + ソーシツ
 シンキュー コータイ (新旧交代)
 <シンキュー + コータイ

このような形態・意味上の基準と音韻上の基準のずれは、2語から成る複合語(「単純複合語」「simplex compounds」)においてのみならず、複雑な構造を持つ複合語(「複雑複合語」「complex compounds」)においてもみられる。例えば、(4)に示すような3語から成る名詞結合は、形態・意味上からは複合名詞としての条件を備えているのであるが、音韻上は、第1・第2要素間でCARはかからず、その結果、全体が2つのアクセント句(accentual phrase)に分解してしまう。また、おもしろいことに、これらの複雑複合語は、第2・第3要素間にCARがかかり、第1・第2要素が構成素(constituent)を成す意味・統語構造との間に構造上のずれを示す。

- (4) a) [[[コーム] [シッコー]] [ボーガイ]]
 →コーム シッコーボーガイ (公務執行妨害)
 b) [[[インド] [ヨーロッパ]] [ゴゾク]]
 →インド ヨーロッパゴゾク (インド・ヨーロッパ語族)

これまで、日本語の複合語音韻構造に関しては、実証・理論両方の観点から数多くの研究がなされてきたが(e. g. McCawley, 1968; Higurashi, 1983; Abe, 1986), (2a)(3a)のようにCARによって説明できるもののみを

その研究対象とし、(3b)のように CAR の適用を受けないもの (非複合化複合語 “non-compounding compounds”) は、研究の対象外とされてきた。また、(4) のような複雑複合語の音韻分析もほとんどなされていない。本稿では、独自の非複合化複合語の分析をもとに、日本語の複合語化音韻過程 (prosodic compound formation process) にどのような「意味制約」(semantic constraint) が働いているかを、英語との比較に基づき考察する。

第2節では、まず、従来の複合語音韻研究を概観しながら複合語アクセント規則 (CAR) を略述し、第3節では、「非複合化複合語」を複合語として扱う論拠を示す。次いで、第4節では、非複合化複合語の意味構造を具体的に分析し、複合語化音韻過程にかかる意味制約として定義する。最後に、第5節では、このように定義された意味制約が、複雑複合語の音韻 (アクセント) 構造を統一的に説明できることを示し、併せて、複合語の意味・統語構造と音韻構造間にみられるずれ (cf. (4)) が持つ意味に言及する。

なお、これまで、非複合化複合語・複雑複合語に関する研究が皆無に等しく、また、既存の辞書 (NHK『日本語発音アクセント辞典』、三省堂『明解日本語アクセント辞典』、研究社『和英大辞典』) も多くの例を示していないため、それらの分析に関しては、独自の方法をとらざるをえなかった。用例については、新聞・週刊誌・テレビ等から数百の語例 (約 200 の非複合化複合語と、約 300 の複雑複合語を含む) を収集し、それらを都合 5 人の東京方言話者⁶⁾ に照会することにより、夫々のアクセント構造を確認した。同一の複合語表現について複数の発音 (アクセント構造) が容認される場合は、その変異 (variation) がどのような条件によるものか (e. g. 個人差, 男女差, speech style の差) も併せて考察した。

2. 複合語アクセント規則 (CAR)

上で述べたように、従来の日本語複合語音韻研究は、非複合化複合語や複雑複合語の分析にほとんど目を向けていないのであるが、アクセント変

化を伴う狭義の複合語については、かなり徹底した分析を展開している。細部にわたるところでは、解釈のわかれるところも少なくないが、従来の研究は次の4点ではほとんど一致していると言える。まず第1に、日本語における複合語化過程は、音韻的には、語アクセントの変化規則(accent assignment rule)と定義される。第2に、その規則の内容について、複合語アクセント形式は、一部の例外を除いて、第2(右側)要素の音韻構造により決定され、第1(左側)要素の音韻構造は関与しない。第3に、第2要素が3モーラ以上の複合語は、規則性の高いアクセント変化を示し、ほとんどの場合、第2要素の第1音節⁷⁾に複合語アクセントを受ける：(5a)参照。唯一の例外は、第2要素自身が中高型(medially accented)のアクセント形式を持つ場合で、その場合は、その第2要素のアクセントが複合語アクセントとして保持される：(5b)参照。^{8,9)}

(5) a) シャカイセ⁷イド (社会制度)

＜シャ⁷カイ　＋　セ⁷イド

ニホンア⁷ルプス (日本アルプス)

＜ニホ⁷ン　＋　ア⁷ルプス

キョーイクジョ⁷ーケン (教育条件)

＜キョーイク　＋　ジョーケ⁷ン

シャカイセ⁷イサク (社会政策)

＜シャ⁷カイ　＋　セイサク

デンキア⁷イロン (電気アイロン)

＜デ⁷ンキ　＋　アイロン

b) イソップモノガ⁷タリ (イソップ物語)

＜イソ⁷ップ　＋　モノガ⁷タリ

タンコーストラ⁷イキ (炭坑ストライキ)

＜タンコー　＋　ストラ⁷イキ

複合語音韻構造に関する第4の共通認識は、第2要素が2モーラ以下

(つまり、1 モーラか 2 モーラ) の複合語に関するもので、この場合、第 2 要素の性格により、次の 3 つのグループに分類される。第 1 グループは、第 1 要素の最終音節に複合語アクセントを持つもので、このような複合語アクセント形式を生み出す第 2 要素を McCawley(1968)は「アクセント前置形態素」(preaccenting morpheme) と呼ぶ。第 2 グループはアクセント削除形態素」(deaccenting morpheme) によって生み出される無アクセント複合語で、第 3 グループが「語頭アクセント形態素」(initially accenting morpheme) によって作りだされる、第 2 要素の第 1 音節に複合アクセントを持つ複合語である。これらは、(6a)–(6c)で例示する通りであるが、数から言うと、(6a)タイプの形態素／複合語アクセント形式が最も多く、(6b)タイプがこれに次いでいる。

- (6) a) カブト¹ムシ (かぶと虫) <カ¹ブト + ムシ
 ヒジョ¹ーグチ (非常口) <ヒジョ¹ー + クチ
 フランス¹パン <フランス + パ¹ン
- b) シャカイトー (社会党) <シャ¹カイ + ト¹ー
 フーセンダマ (風船玉) <フーセン + タマ¹
 ピンクイロ (ピンク色) ピ¹ンク + イロ¹
- c) ニワカア¹メ (にわか雨) <ニ¹ワカ + ア¹メ
 ペルシャネ¹コ (ペルシャ猫) <ペ¹ルシャ + ネ¹コ
 メタンガ¹ス <メ¹タン + ガ¹ス

(5)・(6)に例述した複合語アクセント規則は、一部の例外こそ許すものの、¹⁰⁾ 二語から成る単純複合語に関する限り、正しくそのアクセント形式を記述することのできるものである。本稿で以下 CAR という場合、(5)・(6)に例証される規則を指すものとする。¹¹⁾

3. 二種類の複合語

日本語の複合語には、複合語アクセント規則 (以下、CAR と略す) の適用

を受けるもの (e. g. (3a)) と受けないもの (e. g. (3b)) の 2 種類があることは、§1 でみた通りである。この立場は、「複合語」というものを形態・統語・意味構造など音韻以外の基準で定義したものであるが、これに対し、音韻論的基準——つまり CAR の適用を受けるか否か——でもって「複合語」を定義しようという立場も無いわけではない。例えば、早田 (1969) では、CAR の適用を受けない名詞結合を「名詞句」(noun phrase) と見做し、(4) のような例に対しては (7) に示される分析を提案している。

- (7) [[[公務]_N [執行]_N]_{NP} [妨害]_N]_N
 [[[インド]_N [ヨーロッパ]_N]_{NP} [語族]_N]_N

(7) のような音韻論的基準に基づく「複合語」の定義・扱いは、CAR を例外のない規則として捉えられるという利点はあるが、次にあげるような大きな問題をいくつか伴う。例えば、「複合語 = CAR の適用を受けるもの」という立場は、「CAR = 複合語に適用される音韻 (アクセント付与) 規則」という定義と循環論となってしまう。つまり、“CAR” の定義の中心概念として「複合語」という概念が必要とされ、その一方で、「複合語」の定義自体が“CAR” という概念を前提としているのである。

この循環論よりさらに大きな問題となるのが、複合語音韻規則の適用を受けるものと受けないものの間に明確な境界線を引くことができないという事実である。例えば、(3b) の名詞結合は (次節で詳述するように)、基底の意味構造が「主語 + 動詞 (形容詞)」、「目的語 + 動詞」といった「格関係」を成しているために、例外的に CAR の適用を免れるのであるが、同じ統語、意味構造を持つ他の名詞結合の中には、CAR の適用を受けるものも多く (e. g. (3a))、両者を区別する基準は、(音韻的基準を除けば) ほとんど恣意的なものである。^{12,13)} 同様の事情は英語にも見られ、複合語音韻規則 (英語の場合 Compound Stress Rule: CSR) の適用を受ける表現 (e. g. (8a)) と受けない表現 (e. g. (8b)) を区別する統語論上の根拠がないことから、後者も「複合語」の範疇に含め、この結果、音韻的には 2 種類の「複合語」

を設定することが一般的となっている(cf. Fudge, 1984 ; Ladd, 1984)。¹⁴⁾

(8)	(a)	(b)
	LONDON Street	London ROAD
	CHRISTMAS cake	Christmas PIE
	FACULTY meening	town MEETING
	APPLE cake	apple PIE

また、日本語の場合、同一表現が個人間、個人内変異として、複合語アクセント形式と句構造アクセント形式の2つのアクセント形式を示すものもあり(e. g. (9)における(a) vs. (b)), 音韻論的基準に基づき複合語を定義しようとするれば、これらの表現は「複合語名詞」―「名詞句」という二重の統語標識を持つことになってしまうのである。¹⁵⁾

- (9) セ¹イシン + ハクジャク (精神薄弱)
→(a) セイシンハ¹クジャク
(b) セ¹イシン ハクジャク
ヒ¹ガイ + モーソー (被害妄想)
→(a) ヒガイモ¹ーソー
(b) ヒ¹ガイ モーソー

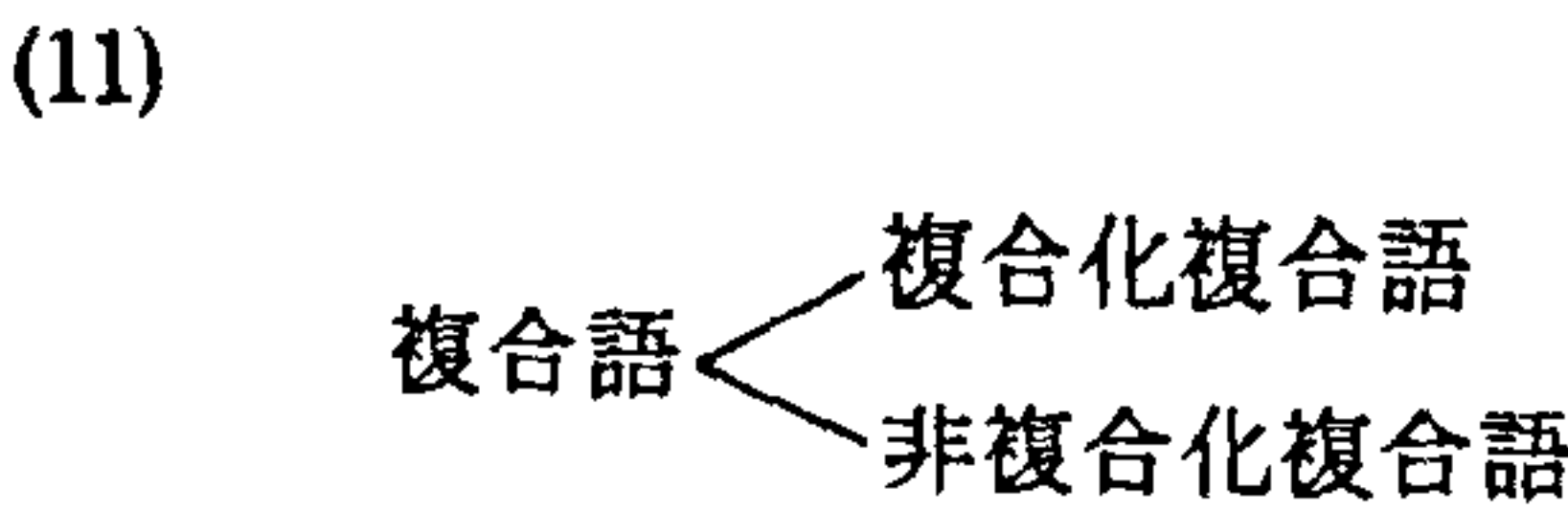
最後に、音韻論的基準による「複合語」の定義は、複雑複合語とその縮約表現間の関係をうまく説明できない。例えば、(10- i),(10- ii)の(a)において、第1要素と第2・第3要素の間にはCARがかからず、この結果、全体が2つのアクセント句に分かれてしまうが、¹⁶⁾ 夫々の縮約表現――(b)――においては、CARが要素間にかかり、1つのアクセント句として実現される。仮に、CAR適用の有無でもって複合名詞―名詞句の区別をしてしまえば、(10a)―(10b)のように同一内容を指示する表現が、縮約の有無で、2つの異なる統語範疇に属することになってしまうのである。

- (10)
- (i)
- a) ニ¹チベイ アンボジョ¹ーヤク (日米安保条約)
- b) ニチベイア¹ンボ (日米安保)
- (ii)
- a) ナ¹ゴヤ コーギョーダ¹イガク (名古屋工業大学)
- b) ナゴヤコ¹ーダイ (名古屋工大)

以上述べたような矛盾点・問題点は、「CAR の適用＝複合語」という音韻的基準を唯一の根拠として言語表現の統語範疇を決定しようとするところに起因するものであり、名詞結合をすべて複合名詞と認める前提に立てば、初めから問題にならないものである。本稿ではこのような理由から、CAR 適用の如何に拘らず、「名詞(形)＋名詞(形)」という統語・形態構造をもつものはすべて「複合語」と見做す立場をとる。そして、この前提のもとつき、CAR の適用を受ける複合語と受けない複合語との間にどのような言語構造の違いが見られるのか、以下、考察を試みる。

4. 意味制約

前節において、CAR の適用を受けず句構造と同じ音韻(アクセント)構造を持つものを「複合語」と認める立場を示した。



§1で述べたように、従来の日本語複合語研究は、非複合化複合語にほとんど注意を払っていないのであるが、数多くの複合語を分析してみると、このタイプの複合語は日本語にかなり多いことがわかる。また(11)に示し

た2種類の複合語の区分は、完全に恣意的なものではなく、結合要素間の意味構造に深く関係していることがわかる。本節では、特定の意味構造がCARの適用を阻止しているものと捉え、これを複合語化音韻過程にかかる「意味制約」(semantic constraint)と呼ぶことにする。¹⁷⁾

4.1. 分類

複合名詞の場合、構成要素(A+B)が、次の(12) – (18)の意味関係を成す場合には、通常、CARの適用を受けず非複合化複合語となる(⇒ Appendix I)。¹⁸⁾

(12) 「格」関係 (case relation)¹⁹⁾ : (3b) 参照

セ¹ンシュ センセイ (選手宣誓)

オ¹ンセイ タジュー (音声多重)

モ¹ンコ カイホー (門戸開放)

オヤカ¹タ ヒノマル (親方日の丸)

(13) 「同格」関係 (coordinate relation)

a) イ¹ップ タサイ (一夫多妻)

タ¹イギ メイブン (大義名分)

b) コーヘイ チューリツ (公平中立)

フヘン フトー (不偏不党)

ボーゼン ジシツ (呆然自失)

c) ハ¹クシュ カッサイ (拍手喝采)

リ¹ッシン シュッセ (立身出世)

イ¹ッシン イッタイ (一進一退)

(14) 人名 : A=姓, B=名

オ¹サノ ケ¹ンジ (小佐野賢治)

ミ¹ナミ ハルオ (三波春男)

チョ¹ー チ¹クン (趙治勲)

テ¹イ エ¹イカン (邱永漢)

(15) A=組織名, B=役職名等

セ¹イフ ヨージン (政府要人)

ボーエ¹イチョー チョーカン (防衛庁長官)

モンブ¹ショー ジ¹カン (文部省次官)

ジチ¹カイ カイチョー (自治会会長)

(16) A=氏名, B=地位・(役)職名

カ¹トー キョージュ (加藤教授)

ユ¹カワ ハ¹カセ (湯川博士)

サ¹ッチャー シュショー (サッチャー首相)

キ¹ング ボ¹クシ (キング牧師)

(17) A=順番を表わす名詞, B=地位・役職名

ジ¹キ ダイト¹ーリョー (次期大統領)

ショ¹ダイ カイチョー (初代会長)

(18) A=地域名, B=Aをさらに指定する名詞

キューシュー ナ¹ンブ (九州南部)

ロ¹ンドン シューヘン (ロンドン周辺)

このうち(12)の「格関係」とは、複合語を構成する2要素が、「主語＋動詞」(e. g.「選手宣誓」),「主語＋形容(動)詞」(「音声多重」,「意識不明」),「目的語＋動詞」(「自信喪失」,「門戸開放」)といった基底の意味構造と成す場合を示す。(13)の「同格関係」とは、「同義」(「拍手喝采」,「大義名分」),「同位」(「公平中立」),「反意」(「一進一退」)などの意味関係を成す2要素が、対等の立場で結合している場合で、構成素の品詞性から見ると、(a)のように名詞性の名詞——野村(1975)の用語で言えば「体言類」——の結合、(b)形容(動)詞性の名詞——「相言類」——の結合、(c)動詞性の名詞——「用言類」——の結合、以上3つの形式に分類できる。

(14)に示した〔姓＋名〕の意味関係には、日本人の人名の他に、同じ“語

順”(統語構造)を成す中国人, 朝鮮人の人名も含まれるが, [名+姓]の“語順”を持つ西洋人等の人名——e. g. (19)——は含まれない。このことは, 「氏名」を表すという名詞結合全体の意味内容が CAR の適用を阻止するのではなく, 複合語を構成する 2 要素間の意味構造が有意義であることを示している。

- (19) マーガレットサ¹ッチャー (＜マ¹ーガレット + サ¹ッチャー)
ロナルドレ¹ーガン (＜ロナ¹ルド + レ¹ーガン)
ミハエルゴルバ¹チョフ (＜ミハ¹エル + ゴルバ¹チョフ)

(15) (16) についても同様のことが言える。つまり, 複合語全体が特定組織の役職名や特定の役職者を意味していても, 構成要素間に (15) (16) に夫々示した意味関係がない場合には, CAR の適用を受け複合化複合語となる。

- (20) ボーエイダ¹イジン (防衛大臣) <ボーエイ + ダ¹イジン
モンブジ¹カン (文部次官) <モ¹ンブ + ジ¹カン
ジチカ¹イチャー (自治会長) <ジ¹チ + カイチャー
(21) メイヨキ¹ョージュ (名誉教授) <メ¹イヨ + キョージュ
イガクハ¹カセ (医学博士) <イ¹ガク + ハ¹カセ

4.2. 例外

非複合化複合語の意味構造に関する分析によると, 日本語では, (少なくとも) (12) – (18) の 7 つの意味構造が複合名詞において CAR の適用を阻止するのであるが, このような意味構造が CAR に対する制約の絶対条件となるわけではない。例えば, 「格関係」について言えば, (3b) (12) のような例がある一方で, 上記(3a)や (22) のように CAR の適用を受ける複合名詞表現もかなり多く見られる。

- (22) ブンカコ⁷ーリュウ (文化交流) < ブ⁷ンカ + コーリュウ
ジコボ⁷ーエイ (自己防衛) < ジ⁷コ + ボーエイ
チカクヘ⁷ンドー (地殻変動) < チカク + ヘンドー
ケンボーイ⁷ハン (憲法違反) < ケ⁷ンボー + イハン

同様に、他の意味構造においても、(13) – (16) に対し、例外と思われる表現が見い出される(⇒ Appendix II)。

- (23) チュートハ⁷ンバ (中途半端) < チュート + ハンバ
シャクシジ⁷ョーギ (杓子定規) < シ⁷ャクシ + ジョ⁷ーギ
(24) モータ⁷クトー (毛沢東) < モ⁷ー + タ⁷クトー
シューオ⁷ンライ (周恩来) < シ⁷ュー + オ⁷ンライ
タナカカ⁷クエイ (田中角栄) < タナカ + カクエイ
(25) シューギインギ⁷チャー (衆議院議長)
< シューギ⁷イン + ギ⁷チャー
ケンギカイギ⁷イン (県議会議員) < ケンギ⁷カイ + ギ⁷イン
(26) メイジテ⁷ンノー (明治天皇) < メ⁷イジ + テンノ⁷ー
エリザベスジョ⁷ーオー (エリザベス女王)
< エリザ⁷ベス + ジョーオー

(3a) 及び (22) – (26) にみられるような例は、一見すると、§ 4.1. で示した意味構造に基づく一般化の反例として「意味制約」の考え方自体を否定するものと映るかも知れない。しかし、少なくとも筆者の分析による限り、これらの例は(3b), (12) – (18) に対し、決してその絶対数は多くなく、あくまで「例外」として見做すべきであるように思われる。つまり、(3a), (22) – (26) のような複合語は「意味制約」の例外と見做すべきもので、仮に(3b), (12) – (18) を「CAR への例外」とみれば、「「CAR の例外」の例外」と言えるものであろう。

(3a), (22) – (26) のような意味制約への例外と並んで注目すべきものに、

(9)で略述したような2つのアクセント形式を許す複合語がある((27)～(29))。²⁰⁾これらの複合語は、構成要素の意味構造からみると、意味制約の適用を受け、ひいてはCARの適用を免れる条件を備えているのであるが、話者間もしくは同一話者内において、(a)のような非複合化複合語のアクセント形式と並んで、(b)のような複合化複合語のアクセント形式をも許容することから、2つのタイプの複合語の中間に位置するものと解釈することができる(⇒Appendix III)。

(27) 「格関係」

精神薄弱 a)セ¹イシン ハクジャク

b)セイシンハ¹クジャク

被害妄想 a)ヒ¹ガイ モーソー

b)ヒガイモ¹ーソー

(28) 「同格関係」

東西南北 a)ト¹ーザイ ナ¹ンボク

b)トーザイナ¹ンボク

ちんぶんかんぶん a)チンブン カンブン

b)チンブンカ¹ンブン

(29) 人名

ビートたけし a) ビ¹ート タ¹ケシ

b) ビートタ¹ケシ

アントニオ猪木 a) アン¹ト¹ニオ イ¹ノキ

b) アン¹トニオイ¹ノキ

4.3. 意味制約の捉え方

以上の議論から、日本語の「意味制約」には、3つのタイプがあることがわかる。第1のタイプは、(3b)(12)－(18)のように意味制約の適用を受

け、ひいては、CARの適用を受けず、(2b)のような句表現と同じアクセント形式を示すものであり、第2のタイプは、意味制約の適用条件を潜在的に備えながら、その適用を受けず、結果的に通常の複合語——複合化複合語：e. g. (2a)(5)——と同じ複合語アクセント形式を示すものである。そして、第3のタイプが(27)－(29)のように、これら2つのタイプの両方の性格を示すものである。

このように、「意味制約」が例外を許し、かつ「規則」と「例外」の中間的性格を示すものがあるという事実は、とりもなおさず「意味制約」というものが複合語化音韻過程にかかる絶対的制約ではなく、「複合語がCARの適用を受けにくくなる度合いを示すもの」であることを示唆している。

このように見てくると、「意味制約」(ひいてはCAR)の厳密な意味での適用・不適用がどのような要因によって決定されるかということが問題となる。上述、3つのタイプの複合語の意味構造を詳細に比較してみると、言語社会で慣用化され、単一概念を表わす度合い——‘one-wordness’の度合い——が強まるほど、複合語は意味制約の適用を受けにくくなるのではないかという印象を受ける。例えば、「同格関係」を成す複合名詞の場合、(13)より(28)の例の方が慣用度(familiarity)が増し、(28)より(23)の方がさらに単一概念を表わす度合いが強いように思える。また、同一話者内の変異についても、特定表現へのなじみが深くなればなるほど意味制約を適用しなくなり、その結果、句構造アクセント形式(e. g. (27a)－(29a))より複合語アクセント形式(e. g. (27b)－(29b))を好む傾向があるように思われる。もし、意味制約の「規則」と「例外」の差異が、多分に、特定複合語表現に対する社会レベル・個人レベルの慣用度の差異を反映しているという解釈が正しいとすれば、これは、複合化複合語と非複合化複合語の意味上の境界が漸次的性格を持っており、個々の複合語に対する社会的・個人的慣用度の度合いによって、その境界が変動することを意味していることになる。つまり、意味制約に抵触するような有標の(marked)意味構造を含む複合語表現であっても、その表現にたいする話者の慣用度が増すに従い、

話者の lexicon において、その有標性が薄れてゆき、その結果、CAR の適用を受ける度合いが増してゆくことができる (図 30)。

<p>(30) [+意味制約]</p> <p> = [-CAR]</p>	<p> [-意味制約]</p> <p> = [+CAR]</p>	
<p>例：(3b), (12)-(18)</p>	<p>(27)-(29)</p>	<p>(3a), (22)-(26)</p>

このように、意味制約の適用・不適用の境界は、複合語の「慣用度」という要因によって大きく左右されるように思えるが、その一方で、意味制約の適用を受ける複合語表現とその適用を免れるものとの区分が、「慣用度」などの基準で説明のつかない場合も数多く見いだされる。例えば、「意識不明」、「自信喪失」、「新旧交代」(以上(3b))、「防衛庁長官」(15)に対し、「行方不明」、「記憶喪失」、「世代交代」(以上(3a))、「衆議院議長」(25)が何故、意味制約の適用を受けないのか——或いは逆に、何故、前者グループが慣用度が比較的高いにも拘わらず、意味制約を依然として受けるのか——単に「慣用度」という観点からは説明がつけがたい。このような諸例を見る限り、異なる複合語表現間では、意味制約を受けるか否かの基準が、かなり恣意的であると言わざるをえないように思える。つまり、同一表現については「慣用度」などの要因が、意味制約の適用・不適用を決定づけているものの、異なる複合語表現間については、その区分は恣意的で、この意味において、複合化複合語と非複合化複合語の厳密な意味での境界は予測不可能と言わざるをえないのである。

4.4. 統一原理

§ 4.2., § 4.3.において意味制約への例外とその意味を考察したのであるが、ここで議論を意味制約を受ける複合語に戻し、その制約を受けない通常の複合化複合語 (e. g. (2a)・(5)) との違いについて考えてみる。

§4.1.において意味制約を7つの意味構造—(12)～(18)—に区分したのであるが、何故このような意味構造を持つ名詞結合がCARの適用を妨げる傾向にあるのか、また、これらの7つのケースを総括する原理は何かという疑問が湧いてくる。²¹⁾ (12)～(18)の例をみると、固有名詞を含む名詞結合はCARの適用を受けにくいのではないか、あるいは、第1要素が第2要素の表す概念を下位範疇化(subcategorize)しない場合はCARが適用しなくなるのではないかという印象を受ける。前者の考えについては、確かに(14)(16)(18)の3つのケースを見る限り一般性があるように思えるのであるが、その一方で、(31)に例示するように、日本語ではこの種の名詞結合でCARの適用を受ける例は非常に多く、意味制約と「固有名詞」という概念が直接結びつかないことは明らかである。

(31)

- a) トーキョーダ¹イガク (東京大学)
- b) ニホンギ¹ンコー (日本銀行)
- c) ミキナ¹イカク (三木内閣)
- d) レーガンセ¹イケン (レーガン政権)
- e) ナゴヤ¹エキ (名古屋駅)
- f) メイジイ¹シン (明治維新)
- g) エドヅ¹ダイ (江戸時代)
- h) キョートタ¹ワー (京都タワー)

同様に、「下位範疇化」という概念は一見(12)～(18)の諸例を統一的に説明できるように見える。例えば、「防衛庁長官」(15)は特定の人物、役職を指示するものの、特定種類の「長官」を意味するものではなく、また「湯川博士」(16)、「次期大統領」(17)も夫々、「博士」、「大統領」という名詞が表す概念を下位区分するものではない。一方、§1であげた通常の複合化複合語——(2a),(5)——では、ほとんどの場合、第1要素が第2要素の修飾語として後者の意味する概念を下位範疇化しており、また、同じ役職名で

も (20) (21) にあげた例など (e. g. 「防衛大臣」, 「医学博士」) は, その点 CAR の適用を受ける条件を持っているといえる。

このような例は, 確かに「下位範疇化」という概念が CAR の適用の如何と深く関係していることを示唆しているが, その一方で, 「下位範疇化」と CAR の適用が完全に合致しない例も数多く見受けられる。例えば, 固有名詞を表わす複合語は, 日本語においては多くが CAR の適用を受け複合化複合語となるのであるが, (31) の例からもわかるように, このような複合名詞は, 決して「第 1 要素による第 2 要素の下位範疇化」という条件を満たさない——「東京大学」, 「日本銀行」は, (「国立大学」, 「都市銀行」などといった複合語表現とは違い) 大学・銀行の種類を特定化するものではない。このような例は, とりもなおさず, 「下位範疇化」の条件が整わなくても CAR が適用しうるということを意味し, 「下位範疇化」という条件が, CAR 適用の十分条件であっても必要条件ではないことを示唆している：(32), (33) 参照。

(32)

	複合化複合語 (CAR 適用)	非複合化複合語 (CAR 不適用)
〔+下位範疇化〕	あり	なし
〔-下位範疇化〕	あり	あり

(33) 第 1 要素が第 2 要素 (の概念) を下位範疇化

↓

複合化複合語 (CAR の適用)

以上の論議からもわかるように, § 4.1. で分類した 7 つの意味構造は, 「固有名詞」という構成要素の特定特性や「下位範疇化」という要素間の

特定の意味関係では総括的に説明することはできない。また、今のところ、これ以外でも適当な統一原理が見当たらないため、結局、基底における共通性につかめないまま「意味制約」という形で総称せざるを得ないように思える。この点、今後の研究課題として残る問題である。

4.5. 英語との類似性

英語の複合語にも複合語音韻規則(CSR)の適用を受けるものと受けないものの2種類があることは§3で述べた。Kingdom (1958) や Fudge (1984) の研究によると、英語の場合も日本語の場合同様、複合化複合語と非複合化複合語の境界はかなり恣意的であるものの(cf. (8)), 完全に恣意的かというとはそうではなく、構成素間の意味関係や複合語全体の意味構造によって決定されるところも大きいという。

このような観点から英語の非複合化複合語を分析してみると、英語の複合語における意味制約は日本語複合語における意味制約と極めて共通点が多いことがわかる。²²⁾ 例えば、同格構造の複合名詞は、(絶対数は少ないものの) 通常、非複合化複合語となる。

(34) king-EMPEROR (王である皇帝)

cook-HOUSEKEEPER (料理人兼女中頭)

historian-POLITICIAN (歴史家であり政治家である人)

producer-DIRECTOR (製作者兼演出者)

——Adams (1973)

同様に、「氏名」や「職名＋氏名」を表す名詞結合も、語順の違いこそあれ(日本語は「姓＋名」「氏名＋職名」、英語は「名＋姓」「職名＋氏名」), 複合語音韻規則の適用を免れる点では一致し—— (35), (36) ——, また「組織名＋役職名」という意味構造の複合名詞も日本語の場合と同じように複合語音韻規則の適用を受けないものが多い—— (37)。

(35) (vs. (14))

William SMITH, Mary BROWN

—Fudge (1984: 145)

(36) (vs. (16))

Professor HIGGINS, Colonel PICKERING

President REAGAN, Doctor JONES

(37) (vs. (15))

department CHAIRMAN, company EXECUTIVE

team MANAGER, university PROFESSOR

Fudge (pp. 144-9)の分類と比較してみる限りでは、一般に英語の方が意味制約の適用範囲は多岐にわたっており、日本語ではCARの適用を受けるような場合でも非複合化複合語となっているものが多いように思われるが、²³⁾ いずれにしても、(13) – (16) と (34) – (37)に見られるような日英語間の共通性は、CARの適用・不適用という問題が、決して各言語において恣意的なものではなく、複合語構成要素間の意味関係と深く関係し、しかもそれが言語体系の違いを越えたものであることを示唆していると言えよう。また、このような観点から日英語以外の言語へ分析を広げてゆけば、個別言語の研究ではわからなかった意味制約の一般原理というものが明らかとなり、普遍的意味制約として一般化できるようになるかもしれないのである。

5. 複雑複合語と意味制約

前節までは、専ら2要素から成る単純複合語(simplex compounds)における意味制約の働きを論じてきたが、意味制約は、3要素以上から成る複雑複合語(complex compounds)²⁴⁾においても顕著に現れる。本節では、「意味制約」の概念が、複雑複合語の音韻構造の説明に、如何に不可欠なもの

であるかを論じ、併せて、複雑複合語のアクセント句構造が、日本語の統語構造と音韻構造の対応関係にどのような知見を与えるか、考察してみる。

5.1. 3要素複合語

3要素から成る複合名詞は、(38)に示されるように、複合語全体がCARの適用を受け、単一のアクセント句から成る場合も多いが、その一方で、§1の(4)であげたような2つのアクセント句に分解されるものも少なくない。

(38) a) シャカイクシセ¹イド (社会福祉制度)

＜シャ¹カイ＋フ¹クシ＋セ¹イド

b) ホゴボーエキシュ¹ギ (保護貿易主義)

＜ホ¹ゴ＋ボーエキ＋シュ¹ギ

c) ミニスカートス¹ガタ (ミニスカート姿)

＜ミ¹ニ＋スカ¹ート＋ス¹ガタ

このうち、複数個のアクセント句に分解してしまう例を、その要因について分析してみると、2つのタイプに分かれることがわかる。その1つは、右枝分かれ構造を含むもので、——cf. (10a)——この構造が有標構造としてCARの適用を阻止してしまうため、複数個のアクセント句を生み出してしまうものである。——Kubozono (1985)は、これを“syntactic constraint” (統語制約) として定式化している。(より詳しくは、Kubozono (forthcoming)を参照のこと)。

複数個のアクセント句に分解してしまうもう1つのタイプの複雑複合語は、§4.1.で論じた有標の意味構造を含むもので、7つに分類した意味構造(12)～(18)の中でも、特に(12)格関係と(13)同格関係の名詞結合を含むものが多い(他の5つの意味構造は、それ自体、あまり複雑複合語には現われない)。上記(4)にあげたものが、その代表例であるが、これ以外でも(39),

(40) にあがるように数多く見い出される²⁵⁾ (⇒ Appendix IV)。

(39) [[AB] C] : [AB]=格関係

- a) オ¹ンセイ タジューホ¹ーソー (音声多重放送)
- b) モ¹ンコ カイホーセ¹イサク (門戸開放政策)
- c) ダ¹ンジョ ビョードーホ¹ーアン (男女平等法案)
- d) ケ¹ンポー カイセイモ¹ンダイ (憲法改正問題)
- e) ミ¹ンゾク ジケツシュ¹ギ (民族自決主義)
- f) フ¹ジョ ボーコ¹ーザイ (婦女暴行罪)

(40) [[AB] C] : [AB]=同格関係

- a) ジュ¹ー ミンケンウ¹ンドー (自由民権運動)
- b) ジュ¹ー ミンシュト¹ー²⁶⁾ (自由民主党)
- c) イ¹ップ タサイセ¹イド (一夫多妻制度)
- d) マ¹ルクス レーニンシュ¹ギ (マルクス・レーニン主義)
- e) ジ¹シュ ドクリツウ¹ンドー (自主独立運動)
- f) サ¹ッチャー レーガンカ¹イダン
(サッチャー・レーガン会談)

これらの複合語に共通していることは、第1要素と第2要素が、意味制約に抵触する有標意味構造を成し、その結果、その2要素間にアクセント句境界を含む2つのアクセント句に分解してしまうことである。もっとも、これらの中には、(39)、(40)に示したような二分アクセント句構造と併せて、単一アクセント句構造 (e. g. オンセイタジューホ¹ーソー)を示すものも少なくないが、無標の複合語構造が複数個のアクセント句に分解することはないという事実 (e. g. (38) *シャ¹カイ フクシセ¹イド)を考え合わせると、意味制約が複雑複合語でもその効果を及ぼしていることは明白であろう。

単純複合語において意味制約が一定の例外を許すことは§4.2.で述べた通りであるが、複雑複合語でも同様の現象がみられる。例えば、(41)の例は、

厳密には意味制約に抵触する意味構造を含んでいるのであるが、実際には、その制約の適用を免れ、その結果、単一のアクセント句を構成する。

- (41) a) ユクエフメイジョータイ (行方不明状態)
b) キオクソーシツショー²⁷⁾ (記憶喪失症)
c) ブンカコーリ्यूーケイカク (文化交流計画)
d) キノーカイフククンレン (機能回復訓練)

5.2. 4 要素複合語

4 語以上の要素から成る複合語の場合も、何ら有標の意味構造・統語構造を含まないものは、単一のアクセント句として実現する。²⁸⁾

(42)

- a) シャカイフクシセイサクモンダイ (社会福祉政策問題)
b) ホゴボーエキシュギホーアン (保護貿易主義法案)

ところが、意味制約に抵触する意味構造を含むものは、内部で CAR の適用が阻止され、複数個のアクセント句に具現される。例えば、(43)、(44) のように第 1 要素と第 2 要素が有標の意味構造を含む場合、その 2 要素間にアクセント句境界を持つ二分アクセント句構造となる(⇒ Appendix V (1))。

(43) [[[AB] C] D] : [AB]=格関係

- a) コーム シッコーボーガイズイ (公務執行妨害罪)
b) ダンジョ キョーガクセイドモンダイ (男女共学制度問題)
c) イシ ユーグーゼイセイホーアン (医師優遇税制法案)

(44) [[[AB] C] D] : [AB]=同格関係

- a) ジュー ミンシュトータイカイ (自由民主党大会)
b) マルクス レニンシュギシツ

(マルクス・レーニン主義思想)

c) ジュール ミンケンウンドーシ (自由民権運動史)

同様に、(45)のように、第1・第2要素と第3要素が格構造を成すような場合、当該要素間(この場合、第2要素と第3要素の間)にアクセント句境界を持つアクセント句構造を示す(⇒ Appendix V(2))。

(45) [[([AB] C] D] : [[AB] C]=格関係

a) ニホンレツトー カイゾーロン (日本列島改造論)

b) ホッポーリョード ヘンカンモツンダイ (北方領土返還問題)

c) ニホンブツンカ ケンキューセツンター

(日本文化研究センター)

d) カンボジアナツンミン キューエンウツンドー

(カンボジア難民救援運動)

意味制約は同一複合語内で2度以上適用されることもあり得る。例えば、第1・第2・第3要素が対等の関係で同格構造を成す場合(46)や、第1・第2要素が格関係を成し、また、それが結合して第3要素と格関係を成す場合(47)、第1・第2要素がお互い同格関係を成し、その結合体が第3要素と格関係を成す場合(48)、いずれも、第1・第2要素間と第2・第3要素間にアクセント句境界を伴う三分アクセント句構造を形成する。

(46) キョーイク カツガク ブンカキツカン ((国連)教育科学文化機関)

オーアツメ キョーフー ハローチューイツホー

(大雨強風波浪注意報)

(47)

オリンピック ユーチ ハンタイウツンドー

(オリンピック誘致反対運動)

チツギン ネアゲ ヨーキューウツンドー

(賃金値上げ要求運動)

(48) ゼ¹ンコク ゼ¹ンド コーエンカコ¹ーソー (全国全土公園化構想)

5.3. 意味制約＋統語(枝分かれ)制約

§§ 5.1.～5.2.では、複雑複合語において意味制約が適用される例を考察したが、意味制約がもう1つの制約—統語(枝分かれ)制約—と一緒に単一複合語表現に適用されることも珍しくない。例えば、(49)においては、第2・第3要素が同格関係にあることから、この2要素間にアクセント境界が現われ、同時に、統語制約によって、第1・第2要素間にアクセント境界が現われる。また、(50)のように、第1・第2要素の連続が意味制約に抵触し、第2・第3要素の連続(厳密には、第1・第2要素の連続と第3・第4要素の連続)が、統語制約に抵触する場合も、同じ三分アクセント句構造を示す。

(49) [A [[BC] D]]

a) ニ¹チペイ ツーショ¹ー ギョギョー¹ジョ¹ーヤク

(日米通商漁業条約)

b) ニホ¹ン デンシン デンワコ¹ーシャ (日本電信電話公社)

(50) [[AB] [CD]]

a) ヨ¹シノ ク¹マノ コクリツコ¹ーエン (吉野熊野国立公園)

b) デンシン デンワ カブシキガ¹イシャ (電信電話株式会社)

5.4. 音韻構造 vs 統語・意味構造

複雑複合語のアクセント句構造は、意味制約と統語制約の2つの制約を設定することにより、ほとんど全て説明することができる。この点においても「意味制約」という概念は、日本語複合語の音韻構造の説明に欠くことのできない重要なものであるが、その一方でこの結果生じるアクセント

句構造は、日本語の統語・意味構造と音韻構造の関係を論じる上で、極めて重要な意味を持っている。

例えば、(39)、(40) で論じた複合語の場合、第 1・第 2 要素間で CAR の適用が妨げられる一方で、第 2・第 3 要素間には CAR がかかり、この結果、第 2・第 3 要素が第 1 要素とは別のアクセント句を構成してしまう。換言すれば、複合語の統語・意味構造上は、第 1・第 2 要素が構成素を成すのに対し、音韻(アクセント句)構造では、第 2・第 3 要素が 1 つの構成素を成す形となる——(51) 参照。このような統語・意味構造と音韻構造のずれ(discrepancy)は、4 語(以上)の要素から成る複合語にも、ごく普通に見られる。(43)～(50)の場合は、(52)～(57)のような対応関係を示す。(ここではアクセント句境界を“/”で表わす)。

	統語(意味)構造	音韻構造
(51) (= (39), (40))	[[AB] C]	A/BC
(52) (= (43), (44))	[[[AB] C] D]	A/BCD
(53) (= (45))	[[[AB] C] D]	A/B/CD
(54) (= (46))	[[ABC] D]	A/B/CD
(55) (= (47), (48))	[[[AB] C] D]	A/B/CD
(56) (= (49))	[A [[BC] D]]	A/B/CD
(57) (= (50))	[[AB] [CD]]	A/B/CD

(51)～(57)を比較考察するとわかるように、これらの例にみられる統語・意味構造—音韻構造のずれは、それぞれ別の原理に基づくものではなく、単一の原理に帰することのできるものである。(51)を例にとると、統語・意味構造で下位構成素を成す 2 要素(AB)間で CAR が阻止されても、それ以外の要素間(BC 間)では、CAR の適用が妨げられることはない。(52)～(57)の各例においても、これと同じ原理が働いており、その結果、統語・意味構造と音韻の多様なずれが生じているのである。

このような統語・意味構造—音韻構造のずれ、及び、その背後にある原

理は、両構造の対応関係、もしくは変換規則(mapping rules)を考察する際に重要であるが、同時に、音韻規則の適用様式に関して、1つの示唆を与えてくれる。すなわち、CAR というアクセント句形成(ならびに、アクセント再付与)規則は、統語(意味)構成素構造に従って、下位サイクルから上位サイクルに、順次、循環的に(cyclically)適用されるのではなく、末端構成素(terminal elements)間で、統語・意味階層構造(hierarchy)に束縛されず適用されるのではないかというのである。(51) – (57)の各例は、実際このような規則の適用様式でしか説明できないものであるが、²⁹⁾もしこの分析が正しいとすれば、これは、*SPE*(Chomsky&Halle, 1968)以来、日本語の音韻分析にも一般原理として広く受け入れられている³⁰⁾「音韻規則は統語構造に従って循環的に適用される」という大原則にたいする例証(反例、もしくは例外)ということになり、極めて大きな意味をもつものと言えよう。

この問題に関する詳しい議論は Kubozono (forthcoming)に譲ることにするが、(51) – (57)のような統語(意味)構造と音韻構造のずれは、日本語音韻論においては決して例外的なものではないことを強調しておきたい。例えば、複合語化過程以外でも、イントネーション句形成過程において(58)のような統語(意味)構造と音韻(イントネーション句)構造間のずれが生じるのであるが、このような現象は(51) – (57)に示した複合語化過程における「ずれ」と同一の原理に因るものである。(cf. Kubozono (forthcoming))。

(58) a) [[[[オ[↑]ーキナ] [ミミノ]] [ライオン]] (大きな耳のライオン)

→ オ \ キナ ミ / ミノライオン

b) [[[[ナオミノ] [[ウエノ] [アネノ]]] [ユノミ]]

(直美の上の姉の湯呑)

→ ナ / オミノ ウ / エノアネノユノミ

6. 結語

以上、日本語の複合名詞における意味制約の性格と役割について考察してきたが、全体の議論をまとめると、次の5点に要約できる。

第1に、日本語の複合語には、複合語音韻規則(CAR)の適用を受けるもの(複合化複合語)と、受けないもの(非複合化複合語)の二種類がある。複合語の中には、この二種類の複合語の中間に位置するものもあるが、基本的には、この二種類の複合語(及びアクセント構造)の区別・認識が、複雑複合語をはじめ、複合語の示す多様な音韻構造の説明には不可欠となる。またこのようにみてみると、日本語のCARが単なるアクセント付与規則ではなく、語アクセントの消去(deletion)、付加(addition)によって、複数個のアクセント句として具現しうる語の連鎖から単一のアクセント句を生み出す音韻過程であることがわかる。複合化複合語が2個以上の語アクセントを持つことは許されず、逆に、CARの適用を受けなかった非複合化複合語が、句構造(phrase construction)と同じく、複数個のアクセント句をもつのはこのためである。

第2に、複合化複合語と非複合化複合語の区分——すなわち、どの複合語がCAR適用を受け、どの複合語が受けないかという区別——は、完全に恣意的なものではなく、複合語を構成する要素間の意味構造によって決定されるところが大きい。本稿では、これを「意味制約」と名付け、「格関係」「同格関係」など7つの有標の意味構造を特定した。このように定義された意味制約は、かなりの数の例外を許し、また、現在での研究では7つの意味構造を統一的に説明する原理も見い出せないのであるが、CARの適用に対する制約として有意義な一般化を可能にしてくれるものである。

意味制約に関する第3のポイントは、日本語の意味制約と英語の意味制約にかなりの共通性が見られるという事実である。これは、単に、英語におけるCSRの適用・不適用が、日本語同様、複合語構成要素間の意味関係

によって決定されるということだけでなく、その意味関係の内容に、日本語のそれと一致する点が多いということの意味する。これは、複合語の意味構造と音韻構造との間に、抽象的レベルでは、何か普遍的な関わりがあることを示唆しており、上で述べた意味制約の統一原理の問題とも関連して、今後の興味深い研究課題と言えよう。

意味制約に関する残る二つの要点は、共に三語以上から成る複雑複合語の音韻(アクセント句)構造に関するものである。その一つは、複雑複合語の示す多様なアクセント句構造の説明にとって、統語(枝分かれ)制約と並んで、意味制約が重要な役割を果たすということである。換言すると、多くの複雑複合語が複数個のアクセント句に分解・具現する現象は、意味制約と統語(枝分かれ)制約の二つの制約を複合語化音韻過程に課すことによって一般的な現象として捉えることができる。最後に、複雑複合語の音韻構造は、統語・意味上の階層構造と一定のずれを示す場合が珍しくないことを指摘したが、これは、両構造間の対応関係を究明する上で、また、日本語に於ける音韻規則の適用原理を考察する上で重要なデータとなるものである。

以上の5点が本稿の結論であるが、複合語の意味制約をめぐる問題がこれですべて解決したわけではない。本稿では、日本語の意味制約を7つの意味構造に特定化したが、これ以外にも意味制約のケースとして加えるべきものがあるかも知れないし、また、それらの構造に共通する原理の解明も今後の研究を持たねばならない問題である。「複合語」というものを、従来のように単純な構造をもち、CARの適用を受けるものに限定するのではなく、“複合語化しない複合語”(非複合化複合語)や複雑複合語まで研究範囲を広げて、複合語の音韻構造と意味構造の関係などを考察していくことが必要であり、また、日本語・英語といった個別言語内の記述・分析にとどまらず、体系の異なる言語間の相違・類似性を比較考察してみることも今後の研究の一つの視点であるように思える。

註

- 1) 本稿は、日本語複合語の統語構造と音韻構造の関係を論じた Kubozono (1985) の続編を成すものである。本稿で紹介した言語事実の理論的意義や複合化音韻過程の音韻体系全体における位置づけなどの問題については、Kubozono (forthcoming) の第二章 (“Prosodic Compound Formation Process”) を参照されたい。
- 2) 複合語化過程では、アクセントの変化に加え「連濁」(sequential voicing) という音韻変化が起こる：e. g. シャシン→(青) ジャシン, クルマ→(荷) グルマ。しかしながらこの変化は、和語から成る複合語に主に起こる現象で、日本語の複合語の半数以上を占める漢語複合語や外来語複合語では起こらないことが多い：e. g. キカン→* (金融) ギカン, クラブ→* (高級) グラブ。このため「連濁」の有無によって「複合語」を定義づけることはできない。
- 3) 林(監修) (1982：331) に引用されている横山(1979)の研究によると、日本語語彙の半数(三省堂『新明解国語辞典』の見出し語 54,187 語のうち 28,031 語 (=51.2%)) が無アクセント語(平板型)であるという。
- 4) この名詞化規則はアクセント変化を伴うことが少なくない：e. g. アカイ>ア¹カ。また、複合動詞、複合形容詞の場合もこのような(第1要素の)名詞化が起こる：e. g. 「腫れあがる」(ハレル→ハレ), 「読み始める」(ヨ¹ム→ヨミ¹)：「蒸し暑い」(ム¹ス→ムシ¹), 「住みにくい」(ス¹ム→スミ)。
- 5) 日本語の複合語も英語の場合と同じような統語上の制約を受ける。例えば「赤い鉛筆」という名詞句構造は「赤い長い鉛筆」, 「非常に赤い鉛筆」といったように、部分修飾語との共起を許すが、複合語構造はそれを許さない：*「赤長い鉛筆」, *「非常に赤鉛筆」。
- 6) この5人の東京方言話者(男性4人, 女性1人)はいずれも東京ないしはその周辺地域(千葉県, 神奈川県)に生まれ育った30~40才代の日本人である。
- 7) 日本語の語アクセントを担う音韻単位は「音節」(syllable)であり「モーラ」(mora)でない。「音節」と「モーラ」の区別, 及びそれぞれの音韻的役割については Mc Cawley (1978), Vance (1987), Kubozono (forthcoming) を参照されたい。
- 8) (5b)タイプの複合語の中には(5a)タイプの複合語と同じアクセント形式を示すもの(e. g. サト+ココ¹ロ→サトゴ¹コロ(里心)；オヤ+ココ¹ロ→オヤゴ¹コロ(親心))や(5a)(5b)両方のアクセント形式を許すもの(e. g. ナ¹マ+タマ¹ゴ→ナマタ¹マゴ, ナマタマ¹ゴ(生卵)；ホシ+ツキ¹ヨ→ホシヅ¹キヨ, ホシヅキ¹ヨ(星月夜))がある。
- 9) Higurashi (1983)は、(5b)タイプの複合語はすべてその第2要素がそれ自体複合語であるか(e. g. モノガ¹タリ<モノ¹+カタリ), 或いは、外来語(e. g. ストラ¹イキ)であるかのいずれかであると述べているが、これは、ヤマホトト¹ギス(<ヤマ¹+ホトト¹

- ギス), アオムラ⁷サキ (<ア⁷オ+ムラ⁷サキ: 青紫), ヤマトナデ⁷シコ (<ヤ⁷マト+ナデ⁷シコ: 大和撫子) などの諸例から見て誤った一般化であることがわかる。
- 10) 2 モーラ以下の要素どうしが複合化した場合には(6a)–(6c)の規則では説明できないことが多い。例えば, 「パン」, 「党」, 「猫」という 2 モーラ語が「ジャム」, 「野」, 「野良」という 1–2 モーラ語とそれぞれ結合した時, ジャムパン (ジ⁷ャム+パ⁷ン), ヤ⁷トー (ヤ+ト⁷ー), ノラネコ (ノラ+ネ⁷コ) となり, (6) に示した規則の例外となってしまう。一般に, このような短い語どうしが複合化したものは, 複合語アクセント規則の適用を受けないようである: 秋永 (1966) 参照。
- 11) これらの規則の定式化については McCawley (1968), Abe (1986) を参照。
- 12) 次節でみるように, 複合語音韻規則の適用を受けない他の意味構造についても同様のことが言える——(12)–(16) と (22)–(26) を比較されたい。
- 13) 同様に(4a), (4b)とそれぞれ同じ統語・意味構造を持ちながら, 複合語音韻規則の適用を受けるものも存在することから (§ 5.1. の (41) 参照) 両者の境界が微妙であることがわかる。
- 14) 英語の複合語に 2 種類の強勢型(stress pattern)があることは以前よりよく知られている事実である——Sweet (1891), Kingdon (1958), Halle & Keyser (1971), Fudge (1984), Ladd (1984) 参照。ただし下図に示すように, それら 2 種類の強勢型の名称は人によって様々である。

	(8a)タイプ	(8b)タイプ
Kingdon	single-stressed	double-stressed
Sweet	uneven stress	even stress
Halle & Keyser	falling stress	rising stress
Fudge	initial(ly) stress(ed)	final(ly) stress(ed)

- 15) § 4.2. にあげる(27)–(29)の例を参照のこと。
- 16) これは「統語制約」(Syntactic Constraint), 別名「枝分かれ制約」(Branching Constraint)による——本稿 § 5.3., Kubozono (1985), Kubozono (forthcoming) を参照のこと。
- 17) 日本語の複合語化音韻過程はアクセント句形成規則(Accent phrase formation)とアクセント付与規則(CAR)の 2 つの側面から成っている。「意味制約」などの制約は CAR にかかる制約というよりむしろアクセント句形成規則にかかる制約と見た方が妥当と思われるが, 本稿では便宜上この 2 種類の規則を区別せず, 「複合語化音韻過程=CAR」という前提のもとで話を進める。尚, 日本語の複合語化音韻過程を上記 2 つの規則に分解して考える根拠については Kubozono (forthcoming; 第 2 章・第 2 節) を参照されたい。
- 18) この他にも, 第 1 要素に特定の接頭辞がくる場合は非複合化複合語となる: e. g. ボ⁷ー ダイガク (某大学), リョ⁷ー イ⁷シ (両医師)。また非複合化複合語となるもの

は複合名詞以外にも見入だされる。例えば、ノラ^リ クラ^リ (のらりくらり)、ユ^ラユ^ラ (ゆらゆら) のような擬声語・擬態語表現 (複合副詞) や、イ^ッテミ^ル (行ってみる)、カ^イテ イル (書いている) などの複合動詞は、いずれも同格関係の 2 要素から成るもので、このために CAR の適用を受けず 2 つのアクセント単位に具現されるものと考えられる。

- 19) 「格関係」を成す複合名詞の第 2 要素は無アクセント (平板型) の語が多いが、これは単なる偶然ではなく、動詞・形容 (動) 詞性の漢語に無アクセント語が多いことに因る——奥村 (1977: 133) 参照。
- 20) (27) – (29) にあげるような複合語のアクセント句構造については話者間でかなりの差異があるように思われる。
- 21) 英語についてもこの問題に関する研究は少なく、十分に解明されたとは言えない——Ladd (1984) 参照。
- 22) この他にも日本語の複合語と英語の複合語には共通するところが少なくない。例えば複雑複合語の場合、右枝分かれ構造(right-branching structure)より左枝分かれ構造(left-branching structure)のものの方がはるかに多く、両言語において前者は CAR の適用を阻止する。また、右枝分かれ構造複合語の意味構造にも日英語間で共通点が多い——Kubozono (forthcoming) 参照。
- 23) 例えば「地名」等の固有名詞の場合、日本語では通常 CAR の適用を受けるが——(31) 参照——、英語ではその適用を受けず句表現と同じ強勢型となる: e. g. *Shaftesbury AVENUE, Victoria STATION*。
- 24) 筆者の収集した数百の複雑複合語はその大半が漢語から成るもので、和語は漢語や非漢語系外来語と結合する場合 (e. g. 「首つり自殺」, 「パン食い競争」) を除けば比較的少なく (e. g. 「足長おじさん」, 「年越しソバ」), 特に 4 語以上から成る複合語においてはほとんどこの結合形態でしか現われない。日本語の複合語の構成要素に漢語が圧倒的に多いことは、野村 (1977) の研究報告とも合致するものである。
- 25) (39) (40) では第 1 要素がアクセント語(accented word)であるものだけをあげたが、第 1 要素が無アクセント語である場合も基本的に同じアクセント句構造を持つ: e. g. コクジン カイホーウ^ンドー (黒人解放運動); ナンミン キューエンカ^ッドー (難民救援活動); ナカソネ レーガンカ^イダン (中曽根・レーガン会談); ハッオン アクセントジ^ンテン (発音・アクセント辞典)。
- 26) 27) 「党」「症」は共に Mc Cawley(1968)の言う「アクセント削除形態素」(deaccenting morpheme)である——§ 2 の(6b)参照。
- 28) Kubozono (1985)が紹介し Kubozono (forthcoming)が詳述しているように、4 語以上の要素から成る複雑複合語には「意味制約」, 「統語 (枝分かれ) 制約」に加え、もう 1 つの制約 (「リズム制約」(Rhythmic Constraint)) がかかり、本来単一アクセント句を構成すべき複合語が 2 つの句に分解する傾向が見られる: e. g. 東南アジア諸国連合→トーナンアジアショコクレ^ンゴー, トーナンア^シア ショコクレ^ンゴー。

29) 従来の規則適用原理で (51) – (57) の現象を説明しようとするれば、統語構造の「再分析」(reanalysis)を想定するしか道はない。実際、Poser (1984)は一部のイントネーション現象についてこの考え方を提案しているが、(51) – (57) のような現象は日本語音韻論ではごく普通に見い出されるもので、本来「例外」説明のために用いられる「再分析」という概念をここで用いるのは妥当ではない。「再分析」を用いた説明の他の問題点については Kubozono (forthcoming)を参照されたい。

30) 例えば、McCawley (1968), 早田 (1969), Poser (1984) 参照。

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APPENDICES

I. 複合語音韻規則の適用を受けない単純複合語

1. 「格関係」

a) 〔主語＋動詞〕

意気消沈, 満場一致, 大器晩成, 任期满了

政局変動, 民族自決, 意識回復, 意気投合 (→(b)?)

男女共学, (他多数)

b) 〔目的語＋動詞〕

公私混同, 憲法改正, 内需拡大, 指紋押捺

軍備反対, 定数は正, 婦女暴行, 関係改善

初志貫徹, 面会謝絶, 才色兼備, 大政奉還

難局打開, 政権移譲, 祖国開放, 国交回復

意思統一 (他多数)

c) 〔主語＋形容(動)詞〕

機会均等, 感(慨)無量, 自信過剰

再起不能, 実現可能, 意志薄弱, 正体不明

美人薄命, 男女平等, 男女同権, 素行不良 (他多数)

d) 〔副詞＋動詞〕

任意同行, 絶対安静 (cf. 絶対命令)

前代未聞, 自己陶醉

2. 「同格関係」

a) 「同義」

美辞麗句, 千差万別, 無理難題, 一世一代

大胆不敵, 無我夢中, 独立独歩, 疲労困憊

孤立無援，榮枯盛衰，幻覺妄想，四苦八苦
比較対照，一挙一動 （他多数）

b) 「同位」

喜怒哀楽，古今東西，四捨五入
有名無実，老若男女，暴飲暴食 （cf. 無銭飲食）
自業自得，富国強兵，不言実行
西高東低，春夏秋冬，以心伝心
共存共栄， （他多数）

c) 反位

半信半疑，一長一短，一喜一憂

3. 「人名」(略)

4. 「組織名＋役職名」

政府高官，生徒会会長 （cf. 生徒会長）
会社社長 (cf. ワンマン社長)，労組幹部
日本代表，国鉄総裁，各国首脳 （他多数）

5. 「氏名＋地位 (役) 職名」

毛首席，中曽根首相，三木先生
藤田画伯，王監督，山口女史
加藤隊長，伊藤課長 （cf. 営業課長） （他多数）

6. 「順番・序列＋地位・役職名」

元首相，前大統領，現会長

7. 「地域名＋細部指定」(略)

cf. 「特殊接頭辞＋名詞」

超デラックス，各大学，同教授，当大学

II. 「意味制約」の例外

1. 「格関係」

- b) 自然破壊，意思表示，身辺整理，遺産相続
関白宣言，自殺未遂，人格形成，自己紹介
機能回復，世界制覇，現状批判，自己弁護
予算編成，書類送検 （他多数）

c) 栄養不足

d) 自己満足, 車内販売

2. 「同格関係」

技術家庭, 保健体育, 手間暇, 極楽浄土(?)

5. 「氏名+地位・(役)職名」

天皇陛下, 聖徳太子, 出羽海親方

III. I と II の中間型

1. 「格関係」

伸縮自在, 暗中摸索

2. 「同格関係」

花鳥風月, 優柔不断, 完全無欠, 自給自足, 一石二鳥
五十歩百歩

3. 「人名」

フランク永井, 全斗煥, 鄧小平

IV. 三要素複合語→二分アクセント句構造(A/BC)

1. 「[AB] = 「格関係」

大器晩成型, タイトル防衛戦
幼児殺害事件, 国土回復運動
早期解放説, 祖国解放運動
美人薄命論, 男女共学制度
男女同権思想, 内閣不信任案
栄養豊富食品, 内需拡大策

2. 「[AB] = 「同格関係」

大義名分論, 文化経済交流
富国強兵策, 日本・ニュージーランド協会
発音・アクセント辞典, 孤立無援状態
電信・電話料金, 自給自足経済
幻覚妄想状態 (他多数)

cf. 「[[特殊接頭辞+名詞]+名詞]

超有名大学, 対ベトナム政策

V. 四要素複合語→二分アクセント句構造

1. A/BCD

大器晩成型人間, 中国残留孤児問題
増収推進プロジェクトチーム, 男女共学制度問題

2. AB/CD

国内市場開放問題, 外国企業誘致運動
余剰人員解消問題, 議員報酬アップ案
留学期間延長願い, 筑波法案反対闘争

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